REPORT

Provincial Board of Health

ONTARIO

1902

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TWENTY-FIRST ANNUAL REPORT

OF THE

PROVINCIAL BOARD OF HEALTH

OF ONTARIO

BEING FOR THE YEAR

1902.

PRINTED BY ORDER OF

THE LEGISLATIVE ASSEMBLY OF ONTARIO.

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TWENTY-FIRST ANNUAL REPORT

OF THE

PROVINCIAL BOARD OF HEALTH.

To His Honour the Honourable William Mortimer Clark, Esq., *Lieutenant-Governor of Ontario.*

May It Please Your Honour:

The Provincial Board of Health respectfully begs to present, for approval, its Twenty-first Annual Report of work done under the provisions of Chapter 248, R.S.O., 1897.

The Board takes pleasure to draw Your Honour's attention to the high state of the general health of the Province in the matter of contagious diseases, by reference to the study of these, which appears in Chapter II of the Secretary's Report, page 19.

It is there pointed out that notwithstanding the fact that in 1902 the smallpox outbreak, which had appeared in epidemic form in 1901, had continued, yet the total deaths reported from 675 municipalities as due to smallpox, scarlet fever, diphtheria and typhoid fever were only 952. That this is relatively a very satisfactory showing may be gathered by a reference to page 20. From this it appears that the mortality per thousand of 0.48, was lower than in any other country in the list, including Great Britain, in which Scotland was lowest, with a mortality of 0.47 per 1,000.

The variability in the type of different diseases is, however, a matter affecting not alone the mortality rate, but the thoroughness of the measures adopted for dealing with contagious diseases. Thus, as referred to in Chapter II as well as in various reports of the Secretary and Medical Inspector, the mildness of smallpox has made it much more difficult to obtain effective local action than if the type of disease were more virulent. Similarly the need for more stringent measures for dealing with scarlet fever is illustrated by the largely increased deaths, due to an increased virulence in the latter half of 1902. A new set of Scarlet Fever Regulations came into force by Order-in-Council on March 5th, 1903, which it is hoped will assist in limiting this, one of the most fatal diseases of childhood.

The low prevalence of typhoid fever, which is so closely associated with the larger municipal works of our towns and cities, has been a good index of the steady development of waterworks systems and of sewerage systems throughout the Province. The town of Southampton has during the year established a system of waterworks, while Listowel has passed a by-law for sewerage works, and Woodstock and Stratford have formally applied to the Board for permission to extend their works.

The rapid growth of the urban population of the Province, through the development of manufacturing industries in the several cities and towns, is forcing the questions, not only of waterworks but of sewage disposal, into great prominence. Fortunately for the welfare of the public the preliminary steps necessary to their establishment demand that the source of the proposed water supply of any town and the method of disposal of the sewage of any place be submitted to the Provincial Board of Health for approval. Thus a water supply of indifferent quality, or one in danger of pollution, is avoided where at all possible ; while the protection of the interests of one town against any selfish action on the part of another town higher on a stream, the matter of sewage disposal is assured.

The problem of sewage purification has thus been prominently forced upon the municipalities, and, as will be seen by the Special Report on Sewage Disposal made by Dr. J. A. Amyot, page 33, the Board has during the year gone quite fully into the experimental side of the question. The facts therein set forth will be of much value to Municipal Councils and Boards of Health, as serving to indicate what may be expected of septic tanks and the several other methods of sewage disposal.

The scientific and practical aspects of vaccination are discussed in a paper by the Secretary on page 132, in which the relations of the public to compulsory vaccination are set forth. Similarly the social phase of isolation and vaccination in smallpox is set forth on page 128, and the claims of the public who have not been affected and are protected by vaccination are upheld.

Reports of the Conferences on Tuberculosis in Ottawa in April and New York in June, will be found on pages 100 and 103, and the importance of developing practical methods for dealing with this most serious health problem is in these fully illustrated. By nothing probably is the relative social and ethical status of any community measured more accurately than by the degree of intelligent interest shown in this work ; and it would appear from these reports that there is great need for a practical campaign of education being instituted in Ontario.

Other reports, such as the sanitation of barber shops, will be found in Part II, dealing with different phases of public health work. Not the least interesting are the annual reports of the several cities of the Province found in Part III. There is nothing which measures so accurately the advances of public health during the past twenty years as the attitude of the medical officers of local boards of health to the various problems of public health work; and it may be said that by comparison the work done in Ontario cities stands high in the scale, as illustrated on page 19, by the work done in limiting the contagious diseases. The direction by which more comprehensive and scientific work in the counties outside of the larger cities may be carried on, is illustrated in the several quarterly reports of the Secretary, indicating that the townships, villages and towns should be organized into larger health units, so that a single officer's time could wholly be devoted to public health work.

The actual position of public health work as an exact science, is set forth with much clearness in Chapter I, page 8 of the report of the Secretary, and indicates how remarkable has been the evolution of the science of public health during the past quarter of a century.

All of which is respectfully submitted,

H. E. Vaux,
Chairman.

PART I.

REPORT OF THE SECRETARY.

CHAPTER I.

THE EVOLUTION OF PUBLIC HEALTH AS A DEPARTMENT OF GOVERNMENT.

The year 1902 completes twenty-one years of Public Health work under the Act appointing the Provincial Board of Health, and this being the number of years at which a man is supposed to have arrived at the age of maturity, and in this Province may exercise his franchise, it would seem proper that a brief study should be made of the progress which has taken place in the evolution of Public Health work, not only as a branch of State and municipal work, but as an exact science, taking its place in the schools of learning as a part of the curriculum of education and general culture.

In the annual report of the Board for 1891, reference was made to the condition of Medicine in the early days of Ontario, when it was pointed out that as early as 1832 a medical examining and licensing board existed in the Province,* but there is no evidence to show or lead us to believe that any teaching of sanitary science was a part of the requirements of physicians. That opinions as to the relations of insanitary conditions to the spread of disease were then strongly held, may, however, be gathered from a report made in 1832 by the Legislature of the York (Toronto) Hospital and Dispensary. It states : "The great increase in the population of this town and its vicinity, and the misery and wretchedness of the lower classes of emigrants, could not fail to disseminate amongst them disease in its various forms. Typhus fever, in its most malignant form, raged to a most alarming extent ; many of the fatal cases above reported upon have been of this malady, brought into hospitals from the steamboats, or from the confined and filthy parts of the town." How much of the disease referred to was typhus, and how much typhoid, cannot be known; since, though Bretonneau, in 1818, had already distinguished the specific intestinal lesions of certain cases of this fever, it was not till after the work of Sir Wm. Jenner, in 1849, that the final distinction between these two diseases was recognized. Enteric fever having become recognized as a specific disease, its infectious nature and its propagation by the faecal discharges, led many physicians, as Budd, to look upon it as due to a specific agent. It was not, however, until within the period of this Board's existence that the discovery, by Eberth, in 1880, of its bacillus, has given us any certain knowledge of the specific character of the disease.

As was natural, the preventable character of typhoid was not even thought of, as regards its connection with a polluted water supply, at that time, nor, indeed, for many years later. That the medical profession, who were licensed to practice physic, surgery, and midwifery, stood in a high position in those early days may readily be gathered from the minutes of meetings of the Medical Board, as well as from reports in the newspapers of those early days. In 1832, Sir John Colborne, the Governor, had shown a proper sense of his duties when in the approach of cholera on the St. Lawrence, he issued, on June 20th, the following circular to the Chairmen of the Quarter Sessions, Boards of Magistrates, in the several districts of the Province:

> Sir: The contagious disease, which has extended its ravages to Lower Canada, having appeared at Prescott in this Province, it becomes necessary to take immediate precautionary measures for arresting its progress as far as human means can avail. I am, therefore, to acquaint you by command of the Lieutenant-Governor, that His Excellency, in the full confidence that the Legislature will sanction the adoption of any measures which the present exigency may require, requests that you will convene the magistrates of the district, and with their aid form a Board of Health.
>
> (Signed) E. McMahon.

This prompt action in 1832 was followed in 1833 by legislative action, when an "Act to establish Boards of Health" was passed on 13th February.

The epidemic of cholera, recurring in 1834, maintained an activity in public health matters, which, however, became quiescent until 1849, when cholera appeared as an epidemic of great virulence. The old Act of 1833 had seemed inadequate, and the Parliament of Canada (Upper and Lower Canada), owing to the presence of cholera in England, in the autumn of 1848, from Hamburg, passed an Act in April, 1849, for "the establishment of a Central Board of Health," as an amendment to the Act of 5 William IV.

This Act provided for such a Board being created by a commission of the Governor. A report of a meeting of the Toronto City Council in the Globe of 21st June, 1849, illustrates the situation. A heated discussion is stated to have taken place, aldermen protesting that the Act required them to do work according to the instructions of the Central Board, and then bear the expenses besides. The Central Board issued its first regulations from its office, in Montreal, dated June 14th, 1849. The epidemic of that year having died out, the Central Board of Health seems to have passed out of commission till 1866, when cholera, again threatening, became the occasion for new regulations being gazetted on May 3rd. In matters of quarantine, laws had existed as early as 1794 regarding the inspection of vessels coming from foreign ports; but excepting these, nothing more than has been indicated existed except the powers of municipalities to appoint committees of health. Such committees were provided for, and did some routine work in the way of abating nuisances, and dealing with contagious diseases as they appeared.

Speaking generally, it may be said that the spasmodic character of such public health work was due to the inexact knowledge of the nature of contagious diseases. It was known that smallpox was contagious, but, on the other hand, cholera was looked upon as due to some mysterious influence, wholly independent of human agency, and hence non-preventable. As late as 1849 the following was written: "It is no doubt true that when one person takes the cholera another may take it. The atmospheric conditions which produce the one may produce the other. But as to any direct communicability of air from one person to another, it is no more likely in the case of cholera than in the case of a broken leg."

Such was then the condition of public, and largely of scientific, opinion until 1881, when the agitation began for the organization of some permanent central health organization in Ontario. In 1877, after the devastating scourge of yellow fever in the United States, a National Board of Health was formed, which undertook the study of disease, and exercised for the few years of its existence an important advisory influence in the affected States of the

South. Several States, as Massachusetts, New York, and Michigan, had already organized State Boards of Health, which were doing an important work in urging the establishment of Local Boards, and in drawing up rules, which in their advisory capacity they urged municipal authorities to adopt. What was wanted everywhere was scientific authority for the measures they advised ; and science was beginning to supply such.

In 1876, Pasteur had determined the true nature of the contagion of anthrax, and had propounded the axiom "*omne vivum ex ovo.*" Robert Boyle, the great English physicist, had said two centuries before, "that he who could probe to the bottom the nature of ferments and fermentation would probably be more capable than anyone of explaining certain morbid phenomena." Pasteur had deeply pondered these words, and had realized their truth in his studies on the vinegar and other fermentations ; but as regards such studies in relation to diseases, it is curious to note that when in 1873 he was nominated as a candidate for a vacancy in the Free Associates of the Academy of Medicine, he was elected only by one vote, so little were his discoveries comprehended by the foremost physicians of the time in their relation to disease. Up to this time all outside the clinic was looked upon as useless, and viewed with indifference or hostility. Claude Bernard had felt it in the remark that "Physiology can be of no practical use in medicine ; it is but a *science de luxe* which could well be dispensed with," and he made the mournful statement, "No doubt we shall not live to see the blossoming out of scientific medicine ; but such is the fate of humanity ; those that sow in the field of science are not destined to reap the fruit of their labors." Remembering these words, it becomes a source of supreme satisfaction to have been privileged to live during the succeeding quarter of a century, which has seen this prophecy in so large a measure fulfilled. When Villemin, in 1869, after years of experimental research, announced that tuberculosis is a disease which reproduces itself, he was treated almost as a perturber of medical order. Nevertheless, he pointed to the way, and Robert Koch, in 1882, successfully climbed the summit of the Mount of Difficulty.

Davaine, who had already discovered the rod-shaped bodies in the blood of animals affected with anthrax, had called them bacteria, and who said: "They have a place in the classification of living beings," was even in 1873 being attacked for his opinions. It was as late as 1873 when Alphonse Guerin, who was a surgeon during the Commune, and had been led by Pasteur's studies to suspect that the frightful mortality after operations was due to germs, brought Pasteur to the Hotel Dieu, Paris, to witness some of the results of his simple dressings of wounds with layers of cotton wool; and, in 1874, that Pasteur received from Lister, at Edinburgh, a pamphlet and a letter, containing the request that he would read the researches on lactic fermentation, at the same time complimenting Pasteur on his brilliant researches, which, he said, "demonstrated to me the truth of the germ theory of putrefaction."

In 1874 Pasteur illustrated in a sitting of the Academie des Sciences the details which he, a chemist, considered necessary to get rid of the germs that might get into a wound, and in pointing out how cleanliness was the basis of all surgical details, explained , "in this way the advantage accruing to hygiene in hospitals and elsewhere from infinite precautions of cleanliness and the destroying of infectious germs."

In England, Dr. Bastian, of University College, attacked by experiments of much seeming cleverness, Pasteur's theories, and endeavored to prove the possibility of spontaneous generation. Prof. Tyndall, seeing the retroactive influence the publication of such experiments was having, took up the study along the lines of the physics of light to refute these theories, and in a letter to Pasteur said: "For the first time in the history of science we have the right to cherish the sure and certain hope that, as regards epidemic diseases, Medicine will soon be delivered from quackery, and placed on a real scientific basis. When that day arrives, humanity, in my opinion, will know how to recognize that it is to you that will be due the largest share of her gratitude."

Pasteur's greatest triumph in the domain of microbic diseases, as Sedillot characterized them, affecting man and animals, was, however, in 1877. Experimenting on the bacteria, he found by his admirable process of culture, outside organism, that the rods which exist in the blood, and for which he has preserved the name bacteridia, given them by Davaine, are living beings, capable of being indefinitely reproduced in appropriate liquids, after the manner of a plant multiplied by successive cuttings. "The bacteridium does not reproduce itself only under the filamentous form, but also through spores or germs, after the manner of many plants, which present two modes of reproduction: by cutting and by seeds."

Closely following the proof of the cause, and the possibility of reproducing anthrax by inoculating the cultivated bacteria into sheep and cattle, Pasteur made the remarkable discovery that while hens, owing to their normal temperature being several degrees higher that that of sheep, would not under ordinary conditions take anthrax, yet on reducing their temperature during inoculation by chilling them in a bath of water, they sickened and died, and the bacteria were found in their blood, as in that of other animals. He equally proved the dependence of the germ upon temperature, by subsequently raising the temperature of a sick hen, when the fowl recovered, and the germs disappeard from its blood within a few hours. His next discoveries were in chicken cholera, which similarly proved to be a microbic disease, while his experiments discovered the attenuating influence upon the bacteria of oxygen in the cultures.

Following this up, he carried his observations into the wards of the hospitals, and interested himself in discovering the cause of puerperal fever. In 1878 he discovered the chain-like streptococcus in the blood of patients sick with this disease, and announced it before the Academie de Medicine.

It was, however, in 1882 that Pasteur accomplished his crowning glory of accepting the challenge of the Melun Agricultural Society to prove his theory of immunization against anthrax by proceeding to the farm of Pouilly le Fort, and, on May 5th, in the presence of a crowd of farmers, veterinarians and physicians, vaccinated 25 sheep out of a flock of 50 with his attenuated virus or vaccine; again on the 17th he inoculated a stronger virus, and finally on May 31 inoculated the normal virus into the 25 immunized and the 25 others. On June 8th all the latter were dead, and all the first 25, save one, were well.

The fame of this crucial experiment became universal. Public journals could grasp its broad and practical significance, and at the International Congress, in London, in 1882, Pasteur was the unchallenged hero of the hour. The French Government had already bestowed on him "The Grand Cross of the Legion of Honour."

In a special lecture, delivered at the request of the President, Sir James Paget, Pasteur said: "In a fortnight we vaccinated in the Departments surrounding Paris nearly 20,000 sheep, and a great many oxen, cows, and horses. . . . Allow me not to conclude without telling you of the great joy I feel in thinking that it is as a member of the International Medical Congress, sitting in London, that I have made known to you the vaccination of a disease more terrible, perhaps, for domestic animals than is smallpox for man. I have given to the word vaccination an extension, which, I hope, science will consider as an homage to the merit and universal services rendered by Dr. Jenner, one of England's greatest men. It is a great happiness to me to glorify that immortal name on the very soil of the noble and hospitable City of London." Nothing so wonderful had ever occurred before, except, when in the British House of Commons, Jenner was voted £20,000, in 1803, for his services in the interests of humanity and his country.

In 1882 Pasteur attacked the question of swine fever, successfully, and similarly cultivated its vaccine, while Robert Koch, in Germany, directed the attention of the world from the triumphs of the splendid Pasteur to Germany by announcing his discovery of the elusive germ of tuberculosis.

It will be of interest to recall here some of the facts relating to this discovery by the man, who during the decade between 1880-1890 divided the honors with Pasteur, and through developing his method of solid cultures served to make the isolation of the germ of any particular disease an easier and more rapid means than that of Pasteur, who necessarily had to depend on abstracting the specific germ from the blood of his culture animals.

It was in 1884 that Loeffler, sifting the work done by Eberth, Klebs, Letzerich, and others undertook the cultivation and separation of the various bacteria present in diphtheria membrane by utilizing Koch's solid gelatine culture medium. He found diplococci and streptococci, as had others, and by inoculation experiments proved that these were not the true germs of the disease. Pushing his experiments, he found that in the deeper parts of the membrane were present bacteria, which on starting proved to be bacilli. Utilizing this material for cultures, he found that identical organisms were obtained from all the patients, having both the morphological and biological characteristics. Inoculation experiments prove that rats and mice enjoy complete immunity, while guinea pigs fall easy victims, due, it appeared, not to the germs in the blood, but to a poison produced at the seat of inflammation, which causes "an alteration in the walls of the blood vessels, leading to hemorrhages throughout the body." How recent years have verified these first experiments published only two years after Koch's great discovery all know; and how Behring, Yersin, and Roux have since developed the methods of culture on blood-serum, and produced the antitoxin of the disease, which in benefiting humanity stands next in rank to the vaccine of cowpox, the world though its results has become everywhere familiar.

Reference has already been made to the clinical experiments which led Budd, Jenner, and others to believe in a specific cause in typhoid, and in its differentiation from typhus. The study of this latter disease has been but slight, with its lessening prevalence in progressive countries. What it was in 1849 Sir John Simon, referring to the dark courts and alleys of London, in slums of London, states: "Typhus prevails there, too, not as an occasional visitor, but as an habitual pestilence. It is impossible for me, by numbers, to give you the exact fatality of such spots. . . . But this I may tell you, as an illustration of what I mean: that in the few houses of Seven Step Alley and its two offsets, Amelia Place, and Turner Square, there occurred last year 163 parochial cases of fever"; while what its meaning was elsewhere may be judged from the following quotation regarding the deaths occurring amongst the emigrants who died of ship fever, or typhus, at the Grosse Isle quarantine stations in 1847. "According to the hospital returns for the year of 98,106 emigrants inspected at the Port of Quebec, 8,691 were admitted into the Grosse Isle Hospital, and of these 3,226 died, while in addition 2,198 were buried in the cemetery at Grosse Isle, who died on the vessels held in quarantine."

How different then and now may be judged from the report of the Quarantine Station for 1902.

For similar melancholy stories we must to-day go to the cities of the Far East, where with their crowded millions typhus and its fellows, cholera, and the plague, mark the existence of social and unsanitary conditions, which Europe and America have relegated to the limbo of a pre-scientific age.

Smallpox, in 1882, was the first, as it continues to be to-day, of the diseases to which public health authorities on this northern continent, pay special attention ; and with such successful results that since the organization of the Provincial Board of Ontario, there have been in twenty years but 205 deaths. So marvellous, indeed, has been the progress in dealing with this decimating plague of the 18th and earlier centuries, that the public of to-day, unconscious of their privileges, assume too often an attitude of arrogant indifference,begotten of ignorance of what science has been doing for them, which makes it difficult to speak with judicial calmness regarding vaccination. Dr. Jenner, writing in 1801, says: "Upwards of 6,000 persons have now been inoculated with the virus of cowpox, and the far greater part of them have since been inoculated with that of smallpox, and exposed to its infection in every rational way that could be devised, without effect."

What smallpox then meant is shown in the figures collated by Mr. John Simon, showing the deaths in a 1,000 deaths before the discovery of vaccination in Geneva, and from whooping cough, measles, and scarlet fever by age distribution in England in 1847:

	Under 5 years.	Under 10 years.	Over.
Smallpox deaths in 1,000	805	155	40
Whooping cough "	943	52	5
Measles "	883	92	25
Scarlet fever "	656	254	90

To-day deaths from smallpox in the vaccinated are practically unknown in children, and, if in adults, only where revaccination has been neglected.

To quote but another example from early records, Mr. Cross, of Norwich, Eng., in a very severe epidemic which prevailed in 1819, observed minutely 112 families with the following results :

	Number.	Cases of smallpox.	Deaths by smallpox.
Total persons in families	603	202	46
1. Protected by previous smallpox	297	None.	None.
2. Protected by vaccination	91	2	None.
3. Unprotected by vaccination	215	200	46

To-day we can present similar statistics, wherever the conditions make similar observations possible; and in addition we have what was not possible in Jenner's time, an adequate scientific reason for the immunity brought about by vaccination, with the added safeguards in the operation through aseptic surgery, which, if possible then, was not practised or considered wholly unnecessary. It is to the last fifteen years, and to our knowledge of the germ theory of disease, that aseptic glycerinated lymph has become a practical means of inoculation with a pure culture of the vaccine lymph. Immunity through its production of substances in the serum of the blood inimical to the reproduction of germs in the blood lymph has been proved, by the neutralizing action of the serum from smallpox patients, or from vaccinated heifers on vaccine. These facts but add to the glory of Jenner's discovery, and the Chairman of the Committee on Vaccination of the English House of Commons stated in 1802: "Upon the beneficial effects of this discovery I hardly wish to trouble the Committee (of Supply), as I am certain, if the report, which contains the scientific opinion of the first medical men in this country, does not satisfy the House, the united opinion of all the world, the homage of Europe, which has been paid to the discoverer of this blessing, will have its due weight on the minds of his countrymen."

Aphtha. Another disease belonging to the list of those affecting animals, and to some extent man, is foot and mouth disease, or *aphtha epizootica*. On the Continent before 1860, and in England from 1860-70, it prevailed as an epidemic, ruining hundreds of farmers, and destroying thousands of cattle. Klein, in 1885, announced the discovery of its germ as a micrococcus, found in the discharges of the vesicles, and in the tissues ; but this was not confirmed. Within the last five years, however, M. M. Loeffler and Frosch have proved that from a drop of serum from an unbroken aphthous vesicle of foot and mouth disease, some minute lymphatic cells were seen, appearing at times as almost inperceptible points. They are finer than any known bacteria, since they passed through a Berkfeld porcelain filter, and while seeming under the microscope perfectly limpid after filtration, yet a cubic centimetre of the fluid injected into the veins of a cow caused a characteristic attack of aphthous fever.

Rabies. A yet greater gift to mankind was that of the indefatigable M. Pasteur, who, in 1885, announced, if not the discovery of the germ of the disease, that he was able to take the tissues of the spinal cord, and by reducing the virulence of its contained virus, to protect by vaccination men and animals affected with rabies. Within more recent years (1900) Dr. A. Bruschettine seems to have definitely determined its specific germ, as being a short thick bacillus, capable of producing the disease by inoculation experiments. However this may be, the practice of vaccination against hydrophobia has become ordinary medical practice, and Pasteur first showed that the disease depended upon (a) the quantity of virus introduced, (b) the point of its introduction, (c) the virulence of the virus, as determined by the animal yielding the material. Thus, he found that the virus was attenuated when passed from a dog to a monkey, and that by passage through successive animals, the pulp of the spinal cord failed to produce a fatal attack of rabies. He again showed that by taking this weak virus, and passing it in an ascending series through animals, as rabbits, dogs, or guinea-pigs, which increase its virulence, it comes back to a strength that kills, slowly or rapidly, according to will. Thus he found that virus from a dog with street rabies, injected into the rabbit, became so intensified that the incubation period in the dog, of 12 to 14 days, after the 100th passage through animals, became reduced to 6 or 7 days. This Pasteur called *virus fixe*. He further found that virus is attenuated by temperature; and if it be subjected for an hour to a temperature of 50 deg. C. its activity is completely lost, or in half an hour at 60 deg. C. It has been further found that it rapidly loses virulence by exposure to air and sunlight. To develop a practical means of producing a vaccine, Pasteur developed the simple process by which a series of spinal cords from inoculated animals were suspended in sterile flasks, plugged with cotton wool, and maintained at a temperature of 22 deg. C. Pulp made from cord so treated for 24 hours was found slightly less virulent; that at the end of 48 hours less so, and so on till, at the end of the 13th or 14th day, the virus was inactive. This determined, a dog was inoculated with 14th day virus, and so upward again until it withstood the fatal virus fixe, or was completely immunized against rabies. He found by experiment that if animals bitten were injected within five days thereafter, almost all could be saved, and less so as the time lengthened, just as we know is the case with smallpox vaccine. Soon came the occasion for his *experimentum crucis*, when Joseph Meister was bitten badly, on the 4th July, 1885, on the arms and legs by a rabid dog. As he was certain to die, it was resolved to test the new vaccine. Thirteen injections were given within ten days—two on first day with 14-day-old virus, two on second with 11th and 8th day cord, and then on each following day with cord of a day greater in virulence. On the last day he injected the virus from the cord of a rabbit of full virulence. The boy remained well.

This wonderful discovery, which still further spread the fame of Pasteur, has been developed, and now the preparation of serums from the blood of treated animals has become a routine practice.

Tetanus. This disease, though not one which ordinarily appears in epidemic form, nevertheless, though endemically present in most populous districts, has appeared in localized outbreaks, and, owing to its great fatality and painful symptoms which it exhibits, is one to which the attention of bacteriologists was early directed. So early as 1884, Carle and Cattani discovered virus in tetanus that could be inoculated from men to animals ; but it was not until 1889 that the tetanus bacillus was obtained in pure cultures by Kitasato, and also by Tizzoni and Cattani, as an anaerobe, which was spore-bearing. These spores are exceedingly resistant even to moist heat ; but, fortunately, the germs do not develop in free air. Its presence, however, in the earth of gardens and streets in various localities, made it very desirable that investigations be carried on to discover if possible its antitoxin. Behring, Kitasato, Ehrlich and Tizzoni labored at this for some years, and by 1890 the fact of an immunity being established against the disease through the injection of a toxin of graduated strength, was confirmed. Its utility has hitherto been limited by the fact that the quantity of antitoxic serum required for a successful result is at least two thousand times as great after the symptoms of tetanus have appeared, as compared with that required when an injection has been made antecedent to inoculation with the disease. This fact, associated with the further fact that the tetanus germ goes on developing in an ordinary punctured wound without any sign of its presence till the onset of the spasms caused by it, makes any chance of treating the disease successfully by the antitoxin relatively slight. The very complete knowledge which we now possess of the cause of tetanus, and the conditions under which it develops have, however, enabled the surgeon when called upon to treat punctured wounds, to take such steps at the time the wound occurs as will preclude in large measure any danger of its development.

Cholera. The story of cholera epidemics had become little more than a memory to most in Canada by 1882, since the last outbreak of any extent was in 1855, previous outbreaks having appeared in 1832 and 1849. In 1884, its appearance in Toulon, France, having come by way of Egypt, put all Europe in a state of excitement, only possible by the appearance of such a disease. The French Government sent a commission, designated by Pasteur, to Alexandria to study the disease, and Professor Koch, of Berlin, also went there to study the outbreak. The outcome of this work at Alexandra, when the brilliant Thenard, student of Pasteur, was a martyr to science, and that of Toulon, in 1884, resulted in the discovery of the comma bacillus of Koch. This supposed cause became the subject of study and dispute for ten years; but time has only served to confirm the first claim that the germ of cholera, like that of typhoid, grows in the intestines of the patient, and causes death by the toxins produced by it. It is, like typhoid, essentially associated with infected food and water, and the discovery of its cause and methods of its propagation have changed the disease, which formerly caused men to forget their natural duties under the influence of fear, to be as amenable to the operation of sanitary laws as that of any of the other diseases. Thus, as in typhoid, experiments have proved that cholera bacilli have been carried from the dejecta of cholera patients to milk and other articles of diet, as shown by M. Haffkine in the inoculation of sterilized milk exposed in clean vessels to flies, similarly as in typhoid. The use of cholera-infected water for washing cooking utensils has proved especially the mode of the spread of cholera by means of milk. Nurses and others about patients may, of course, through lack of cleanliness, convey the disease. But apart from these causes, as was shown at Hamburg and Altona in 1892, where the first city was decimated and the adjoining one remained free, the cause in the one was polluted water, while Altona had pure water.

Plague. The disease which for two thousand years has horrified the world through its appearance in widespread epidemics has likewise during the past quarter of a century had to submit to the penetrating power of the scientist. Not that it is possible in practice to wholly extirpate the disease; but to-day we are practically informed as to the weapons of defence; and it only requires executive methods to be thorough to stamp out the disease with the same certainty as smallpox.

It is to Kitasato, a Japanese student of the Hygienic Institute of Berlin, made famous through Professor Koch, that we owe the discovery of the bacillus of that plague, which for centuries has prevailed in Oriental countries with a terrible fatality. Not only has this scientist shed glory on his country, but he has won renown throughout the whole world of science through his heroism in exposing himself to the study of an unknown source of danger. He found in the bodies of patients with plague a characteristic bacillus, growing readily outside the body in blood serum, but in severe cases it is found in the blood, being usually more abundant in the lymphatic glands, where the buboes or pustules develop. Inoculation of rats with material from infected rats proves fatal in from one to five days. The disease had been noticed to be disseminated especially where rats abound in a locality, as along the wharves of Eastern cities; and it remained for Simond to prove that the disease seemed to spread directly through the fleas, which, biting sick rats, took the infected blood into their intestines, and then subsequently biting a person inoculated him through the bite. Dust, besides when inhaled or when falling upon food to a limited degree, becomes a source of infection. The recent report of the India Plague Commission concludes that man has, however, been the common medium of transmission. These notable, and what but a few years ago would have been called marvellous, discoveries, have been made still more important by the production of a serum at the Pasteur Institute, Paris, by Yersin, through inoculating horses with a graduated amount of the cultivated bacillus of the disease. The serum has proved to be not only protective by immunizing against the disease, but also to some extent curative in those attacked. As in other diseases, however, the success of this scientific procedure in stamping out the disease will be in direct proportion to the intelligent application of executive methods at the ports of those countries whence vessels from the Orient come.

Malaria. The work of Manson and Ross, within the past five years, indicating the mosquito (culex anopheles) to be the medium of transmission of malaria from one person to another, owing to the fact that the coccidia of the haematozoon malariae multiply in the intestine of the mosquito, and reaching therefrom the poison ducts are injected with the poison into the wound made by the bite had barely been proved, and the possibility shown of preventing malaria in such fever districts as Lagos, in West Africa, by draining the puddles of water, or covering them with petroleum, in which the mosquito develops, when from Havana came the news that Findlay, Reed, and others had actually proved that yellow fever was similarly transmitted. In proof of which a young physician became a martyr to experiment by allowing himself to be bitten by a mosquito previously having bitten a man sick with the disease. He thereafter took the disease and died, the agent of the disease being another mosquito, the Stegomya.

Similarly, prevention has followed by the simple expedient of placing the patients within sick rooms surrounded with mosquito bars, and allowing none of those within to leave, and keeping out absolutely all others, except immunes as attendants. Havana, by thorough treating of the cesspools and puddles, where the mosquito develops, with petroleum has banished the disease, while its introduction is prevented by having all sick persons on ships from infected ports placed on shore in mosquito-proof quarters, any mosquitoes on the vessels killed, and a daily examination of non-immunes, so arriving in the city until their period of incubation is passed.

These several references to the discoveries made during the past twenty years, regarding the causes of diseases, have, as already remarked, been the basis upon which exact regulations for the suppression of the several diseases have become more possible. In the matter of smallpox, vaccination had been made compulsory from years of results based upon experience; scarlet fever had taught that through long isolation its eradication was alone possible, though even during these twenty years physicians have been known to go into the courts and declare its noncontagiousness. Diphtheria was a *questio vexata* twenty years ago, and its origin was described as sporadic, as depending upon pythogenic causes, as decaying animal and vegetable matters; but with the discovery of its bacillus in the discharges of the nose and throat, and the means of its cultivation, it has become possible, in the most exact manner, to limit its spread, by determining the infectiveness of a patient by the presence or absence of the bacillus during convalescence. The knowledge of the bacillus of typhoid and of cholera, and their presence in sewage, has made it possible, by preserving water supplies from pollution, and by disinfection of bowel discharges in patients, to practically eliminate both as causes of mortality in the millions of people in hundreds of cities obtaining their drinking water from public supplies. The simple expedients of protecting the non-immune residents of centres, where malaria and yellow fever tend to prevail, from the bite of infected mosquitos, has made these sources of mortality to be brought within the compass of a prophylaxis possible under health regulations strictly and intelligently enforced.

If, however, we turn to that most fatal of the diseases in temperate climates, tuberculosis, we are met with one, which, unless it be leprosy, in its mode of attack, slow, insidious, now retrograding and deceiving, by raising hopes often doomed to disappointment, yet seldom failing in the end to make its last thrust fatal, presents so many elements of difficulty in the institution of practical measures for its suppression, that we to-day have to confess that the very immensity of the measures to be taken, owing to the enormous number of people affected, the long course of the disease, the cost of treatment, and the intimate relation of the disease to individual habits, social customs and industrial methods, make any executive attempts which hitherto have been possible, confessedly wholly inadequate to cope with the problem.

It is not that we do not know what is needful; but rather, it is that in this disease we would seem to have purposely presented to man the solution of a problem which contains, in a peculiar sense, ethical elements, in which the question, "Am I my brother's keeper?" raised at the dawn of history by the first materialistic philosopher, must be answered in the affirmative before society need ever expect to rid itself of this approbrium of civilization and progress.

But some day, somewhere, and somehow, there will yet be those who, following the teachings of that pure science, which is wisdom personified, shall be able to say, with the yet bound Prometheus: "But my spirit is not wholly cast down; for I know that I have done good to the sons of men, and that they honor the Titan, Prometheus, who has saved them from cold, and hunger, and sickness."

CHAPTER II.

STUDY OF STATISTICS OF CONTAGIOUS DISEASES IN ONTARIO IN 1902.

The diseases reported during the year 1902 have been collated from the 675 Annual Reports of Local Boards of Health, as returned according to law to the Provincial Board of Health. (See page 140.)

The returns include practically all the cases of smallpox which occurred in Ontario in 1902. It is important to note that all of these cases seem to have been reported or brought to the knowledge of the local health authorities, and, indeed, were almost invariably reported at the time of occurrence by the latter to the Provincial Board of Health. The rate of mortality is remarkably low, being 0.44 per cent. The difference between this disease, which we have been accustomed to view with so much dread, from its old-time fatal character, and scarlet fever, which in recent years we had begun to hold in contempt, is well seen in the tables, which show for the latter a mortality of 8.5 per cent. for 1902. Similarly, diphtheria shows a mortality of 15.5 per cent. It is probable, and indeed certain, that in the case of scarlatina, mild cases were frequently not reported; but the great increase in case mortality in 1902 has been, as already pointed out, very remarkable. The same is even more true of typhoid, which in hospitals often does not show a case mortality of over 5 per cent., but in these returns shows a rate of 15.1 per cent.

The returns of cases of tuberculosis have similarly been so imperfect that they have been excluded from the table, since the total deaths are returned in the monthly reports. We find that of scarlet fever, smallpox, and diphtheria, and typhoid, 10,490 cases came under the supervision of Boards of Health, with a mortality of 952, or 9.3 per cent. The distribution of cases by municipalities shows smallpox to have been present in 8 cities, having 386 cases; 40 towns and villages, having 267 cases, and 121 townships, having 2,141 cases. It will thus be seen that the disease was least prevalent in the towns and villages, there having been in cities 1 case to 1,063 persons; in towns and villages, 1 case to 1,690 persons; and in townships, 1 case to 680 persons.

In the instance of scarlet fever, we find that there were 3,458 cases reported, with 290 deaths, or a rate of 8.4 per cent.; 14 cities reported 1,698 cases and 147 deaths, or 8 per cent. of deaths, while 208 towns and villages reported 780, with 70 deaths, or 9 per cent.; while the cases returned by the townships were 979 cases, with 73 deaths, or 7 per cent. It would seem that the notification and mortality in many municipal divisions was much the same; but a closer examination of the tables shows that in some municipalities no cases were reported whatever until a death occurred.

With regard to diphtheria, we find the total cases to have been 2,696, with a mortality of 15 per cent. In the cities there were 1,459, with 214 deaths, or 14.7 per cent; in the towns or villages, 666, and 77 deaths, or 11.6 per cent., and in the townships, 571, with 117 deaths, or 20 per cent. The high case mortality in the townships points to the conclusion that a notable number of cases were not reported until they terminated fatally, and that many which recovered were not reported at all. This is confirmed by such a return as that of Collingwood, where 4 deaths and 4 cases only were reported, or that of St. Vincent Township, with 2 cases and 2 deaths.

Typhoid fever returns for the Province show a total of 1,542 cases and 242 deaths, or a case mortality of 16 per cent. In the cities the cases were 420, with 81 deaths, or 19.3 per cent.; in the towns and villages, 648 and 95 deaths, or 14.1 per cent., and in the townships 474, with 66 deaths, or 13.9 per cent. The explanation of these very notable differences in the mortality rate is very difficult on any other supposition than that of neglect to make returns according to the facts, or not to return cases at all in some instances. The case mortality in the cities, for instance, is double that of the camps of either Chickamauga, in 1898, where 20,000 men of the troops were sick, with a case mortality of 10.5 per cent., or that at Bloomfontein, in 1900, where, with an almost equal number of cases, the mortality rate was almost the same figure. In this, as in other respects, it is apparent that the routine work of our Local Boards of Health is very imperfectly performed.

Taking these four diseases as those including most of the deaths due to preventable disease, excluding tuberculosis, we find that the deaths returned month by month by the Division Registrars were 1,061 cases in a population-return of about 90 per cent. of the total. Roughly, therefore, it may be said that 1,200 deaths occurred in Ontario from this class of diseases. That it is a creditable showing may be gathered from the following table, although several of the Ontario cities are high in the comparative list for cities:

Table Shewing the Number of Cases and Deaths in Different Countries and Cities from Smallpox, Scarlet Fever, Diphtheria and Typhoid.

	Population.	Smallpox.		Scarlet Fever.		Diphtheria.		Typhoid.		Rate per 1,000.
		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	
Ontario (1902)	2,182,942	2,797	12	3,452	290	2,696	408	1,512	242	0.43
England and Wales (1900)	32,526,675	..	85	..	3,844	.....	10,187	..	5,591	0.603
Scotland (1900)	4 472,000	523	53		654	.	771	..	644	0.47
New Jersey (1901)	1,925,781	225	32	2,496	155	3,414	834	944	375	0.72
Ohio (1901)	2.760,656	.....	......	..	......		811		1,143	....
Massachussetts (1900)	2,805,346	104	2	6,396	358	12,641	1,387	2,967	533	0.80
Illinois	4,821,550	......	25	......	643	.....	1,504		1,897	0.80
London, Eng. (1901)	4,544,983	1,710	229	18,381	584	12,158	1,258	3,194	497	0.50
Liverpool (1901)	656,332	37	6	3,310	195	......	209	864	154	0.82
Birmingham (1901)	523,284	......	......	3,314	156	533	85	615	111	0.67
Dublin (1901)	245,001		.....	455	15	150	28	1,038	99	0 54
Boston, Mass. (1901)	573,579	504	74	1,398	210	3,319	353	714	142	1.30
Baltimore (1901)	518,000	21	....	367	11	1,607	164	705	141	0 60
New York (1901)	3,457,202	1,964	410	16,692	1,162	12.056	2,068	2,748	727	1.00
Chicago (1901)	1,758,025	......	4	1,773	165	2,237	495	......	509	0.60
Detroit (1900)	285,704	......	1	......	16	.....	113	......	54	0.99
Montreal (1901)	267.516	......	1	...	242	...	99	......	139	1 80
Toronto (1902)	208.040	28	.....	701	88	893	115	130	25	1.23
Ottawa (1902)	59,928	300	2	689	50	230	28	....	22	1.73
Hamilton (1902)	52 634	5	.....	97	3	106	24	64	7	0.64
Brantford (1902)	16,619	2	.....	37	......	72	12	43	4	0.96
Guelph (1902)	11,496	.....	......	24	......	14	2	16	.....	0.17

The table is an interesting one, illustrating, as it does, the high standard of health held by Ontario, as compared with other countries. Incidentally, it may be mentioned, that the rate in Ontario is lower than that for 1901, in which the total deaths were 1,547.

As illustrating another important point, the following table has been prepared, giving the percentage of deaths to cases in a number of cities:

Table showing the Percentage of Deaths to Cases from Smallpox, Scarlet Fever, Diphtheria and Typhoid in different Cities.

Table giving Percentage of Deaths to Cases in Cities.

Cities.	Smallpox.	Scarlet fever.	Diphtheria.	Typhoid.
	Per cent.	Per cent.	Per cent.	Per cent.
London	13.3	3.17	10.03	15.5
Liverpool	16.2	5.8	12.5	17.8
Birmingham	None.	4.7	16.0	17 8
Dublin	None.	3.2	18.7	9 06
New York	25.9	6 96	17.1	26 4
Boston	14.68	15.02	10.63	19 77
Baltimore (1901)	None.	3 03	10.02	20.7
Toronto (1902)	None.	12.5	12.8	19.1
Ottawa (1902)	None.	7.5	13.0	Cases not given.
" (four months of 1903 in new hospital)	....	2.2	10.4	....
Hamilton	None.	3.09	22.6	10.9
Brantford	None.	None.	16 6	9.3
Guelph	None.	None.	14 2	None.

The variations in the type of the several diseases, or in the facilities and methods of treatment, are fully indicated in the mortality rates in the widely separated centres. Thus smallpox, of a high mortality rate, appeared on both sides of the Atlantic, the cases in New York and Boston having their sources in emigrants from Europe.

The inland cities had cases of the mild Cuban type, with few deaths. On the other hand, scarlet fever in no English city shows a high mortality, whereas Boston had 15.2, Toronto 12.5, and Ottawa 7.5, and New York 6.96 per cent. of deaths. Again, Hamilton had but 3 per cent., while Brantford and Guelph, with 37 and 24 cases respectively, had no deaths.

Typhoid fever similarly is seen to vary notably in its mortality rate to cases; but as the notification of the disease varies greatly in different cities, the comparison in this case is likely to be inconclusive.

Another matter of great practical interest is set forth in the different statistics, showing the provisions for the hospital treatment of the cases.

Such as are available on this point are given in the following table:

The reports from different cities do not give a systematized statement on this point, and some are very imperfect.

Table showing Percentage of Cases of Smallpox, Scarlet Fever, Diphtheria and Typhoid treated in Hospital to total reported Cases.

Cities.	Smallpox.	Scarlet fever	Diphtheria	Typhoid.
	Per cent.	Per cent.	Per cent.	Per cent.
London (Eng.), 1901	97.	78.8	74 8	45.3
Liverpool, 1901	100.	54.9	56.	65.5
Birmingham, 1901	None.	80.	None.	37.
Dublin, 1900	None.	100.	100.	50.
Boston, 1901	......	....	....	......
New York, 1901	100.	7.00	10.00	Not stated.
Toronto, 1899	100.	40.7	72.9	Not stated.
Ottawa, 1902	100.	56.3	90.1	Not stated.

These figures illustrate imperfectly a fact of great practical importance, viz.: the increasing estimation in which hospital treatment is held, not so much in the matter of treatment, as in being a sanitary necessity for stamping out disease. The Metropolitan Asylums Board of London is especially empowered to deal with contagious diseases sent in by the Medical Officers of Health of the different sanitary areas of that city. They had in all in 1901 6,178 beds in 12 hospitals, which can be increased in an emergency, if necessary.

How this accommodation has been developed is seen in the following table:

Percentage of Admissions to Hospitals in London of Total Cases of Smallpox, Scarlet Fever, Diphtheria and Typhoid notified in 1901.

Diseases.	1890.	1895.	1900.	1901.
Smallpox	36 67	84.5	73.56	97.2
Scarlet Fever	42 82	58.2	75 15	78.89
Diphtheria	17 87	41 55	72.48	74.85
Enteric	22.49	24.13	47.70	45 34

It seems little short of marvellous that in a city, with a population of 4,544,983, the machinery should have developed to such a completeness, that 74 per cent. of all the cases of these four most serious contagious diseases should have been treated in hospital, with a resulting decreased mortality, only excelled by the City of Guelph, Ontario, out of the 15 cities given in the table. The Managers' report of the London hospitals points out how, in 1893 and 1895, the percentage of cases in hospitals decreased, owing to the prevalence of these diseases, and insufficient accommodation provided; and further states that the percentage might again fall during an epidemic. The remarkable situation exists, however, that with such abundant accommodation for removal of first cases, the constant result follows, that the sources of epidemics—first cases—are being constantly removed. Sir Charles Cameron, of Dublin, urges in his report: "I would earnestly beg the Committee to bring this important question of hospital accommodation for fever cases before the Council." Dr. E. W. Hope, Medical Officer of Health of Liverpool, in 1901, writing on hospital accommodation, states: "It is now some 16 or 17 years since the necessity for the provision by the City Council of adequate hospital accommodation came into prominence. At that time, however, in Liverpool as elsewhere, public opinion was somewhat unformed, owing to the absence of any experience of the advantages resulting from hospitals, other than work-house hospitals, for their treatment, and there was then little public support in promoting the work; indeed, there was a general reluctance, more especially on the part of those who were least able to isolate or nurse the infected at home, to allowing the patients to be removed to hospital. However, as more beds became available, and the advantages of hospital treatment became more apparent, not only in promoting recovery, but what is of even greater importance, in checking the existence of disease, the public soon began to realize the advantages of these institutions, and at the present time seek as a favor, or demand as a right, that means shall be provided by which persons may be taken care of when suffering from infectious sickness."

Speaking with regard to the work of the year, he further says: "Several circumstances combined during the year to tax very considerably the existing hospital accommodation. Very serious inconvenience was experienced on account of the inability to provide accommodation in hospital for considerable numbers of patients who needed such accommodation. That was notably the case with scarlet fever. These cases had to be left at home, with the inevitable consequence that infection was spread from them as centres, and the disease extended to a very considerable amount." It is further added: "The reduction in the number of cases of this disease, which had been noted in 1900, ceased immediately the removal of patients to hospitals was stopped." How large a part of public health work this question of hospital provision forms in England, may be gathered from The Isolation Hospitals' Act of 1894. Under it the County Councils are to consider the need of such an hospital in any borough, and under section 6, may direct the County Medical Officer of Health to make an enquiry as to the necessity of an Isolation Hospital being established for the use of any particular district, and if he reports that such an hospital ought to be established, the Council may take proceedings to have it established, the same as if a petition had been preferred by a local authority.

As regards the utility of hospitals in lessening the spread of contagion, Dr. Alfred Hill, Medical Officer of Health for Birmingham, speaks in the report of 1901. Referring to the prevalence of scarlet fever, he states that the disease was as prevalent in houses with over three rooms, as in those under, viz.: cases at the rate of 12 houses in every 1,000. He then remarks: "It seems to me, however, very probable that the incidence of the disease would be much greater in the small houses if the cases were kept at home, instead of being removed to hospital. As a matter of fact, in the quarter referred to, 444, or 95 per cent., of the cases in three-roomed houses were removed to hospital. From houses of four rooms and upwards, 85 per cent. of the cases were removed, showing that the hospital is utilized, as it should be, to a greater extent by the tenants of small houses, than of large ones."

It will be noticed in the table given that no satisfactory statistics are available, indicating the percentage of cases treated in hospitals specially set apart for contagious diseases. Indeed, except for smallpox, it would appear that especially England, and even Ontario, are notably in advance of American cities in this matter of separate hospitals for contagious diseases.

With the history of ten years of public health work in England, showing such progress in dealing with outbreaks of contagious disease, we may properly turn to Ontario, and observe the methods which have been in existence, and the progress here of sanitary methods. As regards smallpox, the Ontario Regulations since 1885 have required the removal of cases to hospitals, as provided in Regulation No. 2:

> 3. On the occurrence of the first, or any, case of smallpox in a municipality, the Medical Health Officer shall at once remove the person attacked to the isolation hospital, tent, or other place provided under section 44 of the Public Health Act. 1884, or cause such person to be otherwise efficiently isolated, and shall take proper measures for the disinfection, or if necessary the destruction, of all clothing which may have been exposed to the contagion, and for the disinfection and purification of every conveyance, rail-car, steamboat, sailing-vessel, carriage, or other vehicle, which may have been exposed to the contagion. Sec. 3. Smallpox Regulations

The results of this practice have been so obvious in the instance of smallpox, that it has met with no opposition, and since 1900, when the present epidemic began, the utilization, by towns and township Local Boards of Health, of double-walled tents, has quite frequently been put into practice. In the larger centres permanent buildings have generally been constructed. In the matter of diphtheria and scarlet fever, the practice has varied. The general hospitals, prior to 1890, in a number of instances, as at Toronto, Hamilton, and London, had been in the habit of receiving cases of diphtheria, and to a small extent, those of scarlet fever. The objections to this practice became so obvious, that in most cities and towns annexes, or separate buildings altogether, were erected, and maintained under the supervision of the hospital authorities. Toronto was the first to establish, in 1892, a separate isolation hospital, under the direct control and management of the Local Board of Health; and even yet in other places the management of contagious disease wards, or separate buildings in the General Hospital grounds, is largely under the hospital authorities. In the smaller cities and towns, this practice is convenient, and if admissions and dismissions are made under the authority of the Medical Health Officer, there need be no objection raised to the practice.

Such conveniences for the reception of contagious diseases exist in the following cities and towns:

Table of Cities and Towns with Contagious Diseases Hospitals and Wards.

Toronto	Isolation Hospital—Managed directly by Local Board of Health.
Hamilton	Wards in General Hospital.
Kingston	Wards in General Hospital and Hotel Dieu.
Ottawa (1903)	Isolation Hospital—Managed by Local Board of Health.
London	Separate wards in General Hospital.
Galt	Isolation Hospital, under management of General Hospital for smallpox.
Guelph	Separate annex in General Hospital.
"	" " St. Joseph's Hospital.
Mattawa	Separate annex, under management of General Hospital.
Brantford	Separate building, under management of General Hospital.
Port Arthur	Wards in St. Joseph's Hospital.
Belleville	Separate wards in General Hospital.
Brockville	Separate wards in St. Vincent de Paul.
Collingwood	Separate building at General Hospital.
Peterborough	Nichols Hospital and St. Joseph's Hospital (separate wards).—Under hospital management contracted with by Local Board of Health.
Chatham	Separate building, under management of General Hospital.
"	" " " " St. Joseph's Hospital.
Stratford	No special wards.
Sudbury	Separate building of General Hospital.
"	" " St. Joseph's Hospital.
Huntsville	Separate building of General Hospital.
Berlin	Isolation Hospital, under management of General Hospital.

This list includes all the hospitals receiving Government aid, which, according to the Report of Hospitals and Charities, received cases of contagious disease up to Sept. 30th, 1902. There have been, however, in various smaller municipalities, temporary hospitals or tents, to which cases of these diseases have been removed ; and with the new Regulations dealing with scarlet fever and diphtheria, we may expect that great progress in this direction will be made.

The Regulation requiring the removal of cases to an isolation hospital or tent, is the same in character as for smallpox, while it is supplemented by the following Regulations :

6. Where the emergency demands such measures, he shall further place in another building or tent which shall be provided as prescribed in the Act, all persons who may have been exposed to the contagion, and shall supply them with all necessaries until the period of incubation of the disease shall have elapsed as provided in Section 93 of the Public Health Act. No person who has not had scarlet fever shall go, or be permitted to go, abroad until the period of incubation of the disease has elapsed, and until the clothing or effects worn or carried by or with all persons exposed to the contagion be disinfected as provided in the Act.

Whenever in a house there is a case of scarlet fever, or wherever there are persons isolated in the same on account of exposure or supposed exposure to scarlet fever, no children or other persons shall be permitted to leave the premises until in the opinion of the Medical Health Officer, they and their clothing are free from infection.

7. Whenever a case of scarlet fever has occurred in a child attending any school, the Medical Health Officer shall personally, or through another physician, cause a daily examination to be made of all the children of the school room for at least one week from the date of the occurrence of the last case amongst such children. If any children are absent from such school, a medical examination shall be made of them in the same manner as if they were in attendance at the school.

At the date of writing, the monthly returns of Contagious Diseases in Ontario for January, February, and March, 1903, have been prepared, and the situation of relative immunity of the population of Ontario during twenty

(20) years, from a severe type of scarlet fever, has suddenly and notably changed. In January, 1903, the total deaths returned were 90, in February 104, and in March 100. The rate exceeds that of any year in 30 years, and shows more than three times the mortality for the same months of 1902. The virulence is illustrated by the returns of cases for March, which show 545 cases in 100 municipalities, and 100 deaths, or a case of mortality of nearly 20 per cent.

Such a situation makes evident the historic fact of the remarkable variability in the virulence of scarlet fever, in different outbreaks, in different countries, and even in the same outbreak in the same country. As diphtheria had replaced it in importance in Ontario for many years, it may not be improbable that unless special measures for its repression are exercised, scarlet fever may again replace diphtheria in importance as a disease coming under the attention of public health authorities.

What a survey of the history of public health in different countries, and at different periods in the world's history, makes very evident, is that, with all the progress seen in the science of Preventive medicine during the past century, the unknown quantity which enters into the problem, and which determines the natural virulence of the germs of different diseases, still exists, and is bound to play an important part in tables of mortality, great or little in proportion as the known practical means are put in operation for the suppression of outbreaks by dealing with first cases. How this may be done, together with the results of such methods, is not only illustrated by the quotations from reports of Medical Officers of Health in England, but also by the following statement by the Medical Health Officer of Ottawa, Ontario, regarding the influence of the new isolation hospital of 60 beds, opened in the end of 1902, on the prevalence of scarlet fever and diphtheria:

Memorandum from Dr. R. Law, Medical Health Officer, Ottawa, respecting the Scarlet Fever situation in Ottawa, April 29th, 1903.

	Cases.
Thirty-four houses quarantined contained at end of Dec., 1902	59
The overcrowded old hospital contained	48
A total of	107

(1) At the end of December, immediately preceding the opening of the hospital:

To-day we find thirteen houses quarantined	14
The hospital containing	32
A total of	50

A decline of over one-half.

(2) Comparing total number of cases with corresponding period for 1902, we find:

Month.	1902.	1903.
January	45	48
February	55	31
March	42	32
April	56	21
Total	198	132

A decrease of one-third.

The first month (in 1903) showing a slight increase—the last month the most marked decrease of over 50 per cent.

(3) The number of placards put up during corresponding period of 1902 was 109, as compared with a total of 27 in 1903. The hospital is thus seen to have done away, to a great extent, with the greatly increased risk of infection, the hardship and expense of a quarantine at home, which had to be forced upon so many last year.

(4) Including cases transferred from old hospital and from outside municipalities, 121 cases have been treated in the hospital, with 3 deaths.

"As regards the utility of the new Regulations, I think them excellent, as clearly defining the powers and duties of the local health authorities, and, for the three years preceding the opening of the hospital, a steadily increasing roll of scarlet fever cases has convinced us that thorough measures such as the Regulations call for are the only means of combatting this disease."

The evidence thus adduced regarding the value of a well-equipped hospital in the reduction of diseases and deaths seems so convincing and complete, that nothing need be added to it. In the autumn of 1901, smallpox caught the Ottawa authorities unprepared with hospital conveniences, with the result that within six weeks, forty houses were under quarantine with smallpox. Renovation of the old isolation hospital made their removal within a fortnight possible, with the result that, aided by a general vaccination, the epidemic was rapidly suppressed.

But relatively rapid as has been the development of public health ideas in Ontario in the matter of the zymotic origin of contagious diseases, it is apparent that the supplying of local municipal machinery for carrying out such ideas is greatly in defect of the urgent demands created by the presence of outbreaks of the several diseases. In truth, as in all our aspirations toward higher ideals, our efforts in this are ever falling far short in the results attained. What, of course, is the necessary primary requirement in all movements, onward or upward, is that absolutely clear conceptions of truth be held regarding the matter at issue. The good Spinoza says: "We may have general perceptions regarding matters of common report, more correct deductions when the perception is based upon experience, and still more correct perception when the essence of one thing is inferred from another perceived through the senses."

Hence, if we are to grow in a knowledge of method, to increase our ability to apply broad principles to the problems, which in public health matters seem daily more and more capable of being dealt with along the lines of pure science, it becomes of essential importance that we call to our assistance such an amount of knowledge, based upon actual experience, that we shall be able to indicate a line of action, in dealing with outbreaks of contagious disease, with the same calm certainty as to results, as when a certain volume of water, falling on a turbine through a given number of feet, is recognized as capable of producing a given amount of electro-motive force. Nevertheless, even in this latter, consideration must be had for the efficiency of the dynamo or machine; and this is still more true in all work, like the executive part of public health work, where the human element forms so important a term in the equation. To him we have necessarily to look, if progress is to be possible, for a growing and ever clearer conception of what scientific truth is, and for the development of more systematized methods regarding its application to practical problems.

But what is even more to be looked for, is the enthusiasm begotten of that scientific altruism, which, even apart from its moral aspects, makes personal sacrifice in the interests of the public health, as necessary and inevitable, as that of the philosopher Pascal in the vale of Vaucluse, studying the laws of physics, of plain John Dalton on the Cumberland Hills, experimenting on the determination of the dew-point, or in his little laboratory at Manchester, working out the atomic theory; or of the immortal Pasteur, when exhausted through his labors for the silk growers of his beloved France, he extended his philanthropy to those interested in the industry wherever situated, whether in France, Austria, or Italy.

What is seemingly inevitable is that, as with the apostles of an earlier faith, the bones grow dry, and the enthusiasm of the discoverer becomes the routine of his successor, who does the same work mechanically. As Horatio says of the grave-digger in Hamlet: "Custom has made of it in him a property of easiness." To the apostles of experimental science, based upon new discoveries, public health must increasingly look for new and greater victories; but, as the lives of the early Christian Fathers must be read to illustrate enthusiasm and devotion, so the students of science must continue to return to the fountains, whence have sprung our streams of knowledge, if they are to continue that enthusiastic love of research and of truth, which has made the past of science, in its application to public health so glorious.

"And this to fill us with regard for man,
With apprehension of his passing worth,
Desire to work his proper nature out,
And ascertain his rank and final place,
For these things tend still upward, progress is
The law of life, man is not Man as yet!"

. . . .

"I could not,
Lest his success ran counter to success
Elsewhere; for God is glorified in man,
And to man's glory vowed I soul and limb!"
—Browning's "Paracelsus."

All of which is respectfully submitted.

(Signed) P. H. BRYCE,
Secretary.

CHAPTER III.

REPORT OF THE MEDICAL INSPECTOR OF THE PROVINCIAL BOARD OF HEALTH.

By C. A. Hodgetts, M.B., L.R.C.P., Lond.

To the Chairman and Members of the Provincial Board of Health:

Gentlemen: I have the honor to submit my First Annual Report as Medical Inspector of the Provincial Board of Health, covering a period of fifteen months, dating from October 1st, 1900, and ending December 31st, 1902.

The duties appertaining to the office have been heavy, chiefly owing to the many calls consequent upon the wide diffusion of smallpox, and the difficulties of diagnosis, arising from the continued mild character of the disease.

The work may properly be dealt with under the following heads:

(1) Smallpox inspection—
    (a) In organized municipalities.
    (b) In unorganized districts.
(2) Other sanitary investigations.

The work necessitated visits to municipalities either for the purposes of (a) diagnosis of suspected cases, (b) assisting the local authorities to enforce quarantine, (c) to stimulate them to more active work, and (d) to superintend in the unorganized districts the proper carrying out of the Regulations, and the quarantining of isolated cases of infectious disease.

During the fifteen months I have been absent from Toronto 277 days, and have travelled 25,000 miles and visited 176 municipalities.

Smallpox Inspection in Organized Municipalities.

Difficulties of Diagnosis : It is a regrettable fact, that after three years, with the continued presence of the disease in the Province, the difficulty still exists amongst members of the medical profession in arriving at a correct and early diagnosis of the mild cases, which somewhat resemble chickenpox, yet possessing sufficient clinical differences to make closer observation reveal their true character. I am of the opinion that many cases of so-called chickenpox, which have occurred in children and adults, have been smallpox of a mild type, and that there are many homes in this Province wherein lurks the infection of the latter disease. It should be the duty of all local health authorities, and all members of the medical profession, to direct that disinfection be as thorough after chickenpox as after smallpox, since failure to do so in the past has resulted in a widespread diffusion of the infection, which at any time may break out in the more virulent form.

Indifference to the Disease and to Vaccination: Owing doubtless to the low death rate attending the present epidemic, the greatest indifference is displayed by all classes in regard to the adoption of quarantine, and the enforcement of vaccination. In some few instances there has been considerable display of opposition when the true character of the infection has been pointed out, and active measures have been called for by the Provincial Board. Many persons express themselves as preferring mild smallpox to vaccination, dreading the inconvenience and loss of time so frequently found to follow primary vaccination in adult life.

It cannot, of course, be expected that these objectors are fully informed of the great danger the unvaccinated run when exposed to the disease, even of the mildest type, of smallpox developing, in their case, into the severest form. Much less are they aware, on the other hand, that the successfully vaccinated are always protected, no matter how remote the operation, the degree of protection, however, varying with the number, size, and distinctness of the vaccination scars, the period at which the operation has previously been performed, and the natural immunity of the individual.

Vaccinal Protection; I have yet to meet with a case of varioloid (modified smallpox) in one person well vaccinated or revaccinated within seven years from the date of exposure; while many have been the instances where vaccination only once efficiently performed, even 25 to 30 years previously, has given complete protection, and of the modifying power of vaccination only once performed at a still more remote period of time, this, in one instance, being over 50 years.

That much unnecessary fear and alarm have been aroused against this highly important operation cannot be denied, and it remains with the medical profession and health authorities generally to re-establish confidence. To this end infant vaccination must be insisted on, and secondary vaccination before the children enter upon the wage earning period of life. For this purpose "glycerinated vaccine" alone should be permitted, and the use of the common ivory point become a thing of the past. With a view of still furthering the work, medical students should receive instruction in the technique of the operation of vaccination, a procedure, so far as I am aware, being at present generally neglected in the college course.

Abuse of Certificates: Another serious aspect of the situation, and one presenting great difficulties, is the fact that it has been for years a common practice amongst medical men to issue a certificate of vaccination at the time of performing the operation, without waiting the seven days wherein the virus pursues a certain definitely normal course, and upon which only can a certificate be issued. The number of such improperly certified vaccinations is very large, and it is time the practice was discontinued.

Compulsory Vaccination, its Failure and Remedy. The present method of carrying out compulsory vaccination seems to be quite inadequate to meet the requirements of our social conditions. It is found that the greater number of the employees of factories and workshops are called upon to submit to the operation, and that they resist, fearing a week or two's "lay off," for which they will receive no remuneration. Schood trustees, both public and separate, are alike somewhat reluctant to enforce the compulsory clauses of the Act.

To meet these difficulties it should be required of all employers of labor to adopt the Regulation applicable to unorganized districts, which makes it illegal for them to hire an unvaccinated person. If this requirement were preceded by one making it compulsory for school trustees to admit only vaccinated children to school, and to require certificates of secondary vaccination from all over ten years of age, this suggestion could easily be carried out. Such employees would not be affected at the wage-earning period of life, and we would soon have a well vaccinated population.

Isolation Hospitals: The prevalence of smallpox has forced many municipalities to provide temporary hospital accommodation for such cases, and in many instances this has been done by means of well-constructed double-walled tents, usually 15 by 30 feet in size. Although there were a few objectors at first amongst the patients to their entering these canvas hospitals, yet they have been found in every way to meet the wants of either a city or township. As isolation hospitals they are suitable to rural districts, because of their portable character; and for the towns and smaller cities, from the fact that when not in use, they may be stored away from the public view; while their small cost is another important point for Local Boards of Health to remember.

Vaccination by Glycerinated Vaccine: The greater number of the vaccinations performed during the year have been with the glycerinated product, and on the whole, the results have been very satisfactory. Where the contrary has been the case, it has been due either to the operation being improperly performed, or to the inertness of the vaccine virus itself. To overcome this difficulty, it is quite evident there must be greater care exercised in the handling of the product, since exposure to heat, even for a short period, renders it inert. I am quite convinced that the accident often occurs in transit from the producer to the patient, the fault resting either with the postal department, the express company, the druggist, or the medical man himself, all or any of whom unwittingly may submit it to too great a heat. Hence, too great care cannot be bestowed upon it by keeping the place in which it is kept stored at a low temperature.

Local Medical Health Officers. While the work of the many Local Medical Health Officers in the past has been of untold benefit to the public, and while the public health of the Province has been greatly enhanced thereby it must not be forgotten that often it is performed at great personal inconvenience and financial loss to them. To expect a practicing physician to discharge the important duties of the office for a nominal annual fee, or often without any honorarium, is to expect too much ; and as a result, in cases of an epidemic, the duties are too often imperfectly performed. To meet this difficulty, and for the furtherance of Public Health work, the office should be made a county one, only those possessing the necessary qualifications being chosen to give their time wholly to the work.

Public Health Work in Unorganized Districts.

New Regulations. The introduction of the Regulations of 1901 met with the general approval of the companies concerned, these being especially the lumber companies. The changes thereby brought about by the Regulations were of such a radical character that had it not been for the experience of the previous season, when smallpox was rife in the lumber camps, the difficulties of enforcing the employment of a medical man, and that of vaccination, would have been greatly increased. An old-time custom had to be met, viz., the sale of hospital tickets, a custom which for many years past had afforded the shantyman hospital treatment at the minimum cost of five dollars per annum for non-contagious diseases. The plan, doubtless, was good to a limited extent, yet abused in so far that often the tickets were sold beyond the area of the hospital's usefulness. Now the men appreciate the great advantages derived from the camp hospital, and the untold benefits of a camp physician.

Vaccination of Employees. The enforcement of the regulation relating to compulsory vaccination has caused some inconvenience owing to laborers having been scarce ; but I am pleased to report that the proportion of unvaccinated has been so small that the danger of any serious outbreak in any camp has been averted. About 75 per cent. have been successfully vaccinated ; but this fact should not in any way prevent the yearly enforcement of the Regulations by the employers.

The improvement in the construction of the buildings and the sanitary location of the new camps is already apparent, and there seems to be a strong desire on the part of the firms operating in these districts to comply with the requirements of the Regulations.

As an indication of the good effect of the Regulations, I would state that so far this season smallpox has been reported in only three camps, and in each instance the outbreak was promptly dealt with by the company's physician, efficient quarantine being maintained, and the disease confined to these centres only.

As an illustration of what inspection has meant, the following will illustrate :

P. H. Bryce, Esq.. M.D,
Sec'y Prov. Board of Health.

Dear Sir,—I don't know whether a report on the operation of the Regulations for sanitary control in unorganized districts is required at the present time, however, I am pleased to report that the carrying out of the part pertaining to the medical attendance in this section has been almost a complete success. I have had charge of 28 to 30 camps, for seven different firms here and have had three assistants most of the winter. I had one very good general hospital in the woods and it was filled from Sept. 1st to April 30th and only one death during the winter. We had no appearance of smallpox during the season, nor of any other epidemic.

Yours truly,
W. S. Bued, M.D.

Sudbury Isolation Hospital. The marked improvement in the care of infectious cases happening in the lumber camps was shown by the small number of smallpox patients treated in hospital tents near Sudbury during the winter of 1901-2.

The total number was fifteen, two of these being men who had crossed into this Province from the State of Michigan while suffering from the disease, and for whose care the hospital had to be kept open for a longer period of time than otherwise would have been necessary. For the care of these patients the Dominion Government is indebted to the Provincial Board some $300.

As the Regulations place the responsibility for the care of all cases of sickness occurring in a camp upon the proprietor thereof, the cost of the hospital treatment of the smallpox cases has been charged against any company so responsible. I am pleased to state that so far this winter there has been no necessity for the re-opening of this hospital, and it is not probable there will be any further necessity for it.

Train Inspection at Pembroke and Ottawa. Upon the return of the first parties of shantymen from the Pontiac district, in the Province of Quebec, in the spring of 1902, it became quite apparent that smallpox had existed in the camps during the winter, and that there was danger of the infection being carried to the eastern municipalities. To meet this difficulty there were established two quarantine depots, one at Pembroke, and the second at Ottawa. The local authorities in both instances kindly placed buildings at the disposal of this Board, which were used for detention of the men, and disinfection of their persons, clothing, and effects. Four assistants were appointed to board the C.P.R. trains coming from the west and running into Pembroke, and the Pontiac & Pacific, and the Gatineau R.R., whose terminal is Ottawa. In this manner over twelve hundred men returning to points in this Province were vaccinated, each being detained until they were given a disinfecting bath, and their wearing apparel and effects fumigated with formaldehyde. The saving to the local authorities in the eastern portion of the Province can never be known ; but, judging from the experience of other places in the previous year, before such measures were instituted at Sudbury, it must have been many thousands of dollars ; for undoubtedly the infection was prevented from being carried by these shantymen from the infected Quebec camps. The assistance rendered by the Mayors and Corporation of the City of Ottawa and the Town of Pembroke, as also the Local Boards of Health, and the Medical Health Officers, was of the most cordial character, while the protection afforded these districts by the action of the Province was, it is hoped, fully appreciated.

Quebec Regulations re Camps. The adoption of similar regulations by the authorities of the Province of Quebec as those put into force in this Province materially lessens the danger for all time of infectious diseases being carried from the camps, and will, no doubt, obviate the necessity for train inspection at any time in the future. To further illustrate the value of this work and the appreciation of the Board's efforts, the lumber operators of the Ottawa district conferred in July, 1902, with the officers of the Provincial Boards of Health of Ontario and Quebec, and agreed to advertise that no unvaccinated men would be employed by any of them. Some 25 firms entered into the agreement.

Other Sanitary Investigations. The duties have been so heavy in the handling of smallpox that but little time could be given to outbreaks of other infectious diseases. I have, however, reported on three outbreaks of scarlet fever, and two of enteric fever, and trust that the information obtained, and the suggestions made, in these several outbreaks, have been of benefit to the local authorities.

In conclusion, I desire to thank the numerous Medical Health Officers, medical practitioners, and local authorities for their kind receptions and for the hearty manner in which they have generally co-operated with me in carrying out the provisions of the Act.

I have the honor to be, Sir, your obedient servant.

CHAS. A. HODGETTS,
Medical Inspector.

CHAPTER IV.

REPORT ON METHODS OF SEWAGE DISPOSAL.

At the First Quarterly Meeting of the Provincial Board of Health, held on January 8th, 1902, the Standing Committee on Sewerage presented a report on "Sewage Purification," which gave a *resumé* of the progress of sewage disposal in Ontario during the previous twenty years. After summarizing the results and indicating some of the principal difficulties which municipalities have experienced in dealing with the problem, the Report goes on to state:

> "Clearly, then, the question of sewage disposal is one requiring (a) a thorough practical knowledge of the engineering, geological and agricultural conditions likely to be suitable to any given case; (b) an equally intelligent knowledge of chemical and biological problems necessary to keep the sewage in any given case in a condition most favorable for a rapid and natural decomposition by biological processes, and (c) a consecutiveness of thought and purpose in the oversight and management so that the trained operator will learn thoroughly at least one particular plant so that economy in management with a maximum of good results may legitimately be expected."
>
> "The municipal council, however, which by law is required to adopt such means as will prevent the pollution of the adjacent streams by its sewage, may very naturally ask: How are they to be expected to be equal to such things? The answer of the law is, that the means of abatement must be found by the person who creates the nuisance. It might further be said that a town should not erect industries until they know they can prevent them from becoming nuisances."
>
> "All these answers might equally be given with regard to methods for dealing with contagious diseases, and perhaps with more reason since there are some 2,500 trained physicians in the Province supposed to know all about how to deal with smallpox and other diseases. But as a matter of fact the Government, through this Board, gives constant and great service to municipalities through its officers and laboratory; and there can surely be no logical reason why, if it can be found practicable, in the more difficult and complex biological and chemical problem we are considering, some assistance should not be given, both to improve works already established and to advise in the operation of new works, which with our rapidly growing industries must from year to year be instituted."
>
> "The coming year is likely to see the work taken up in three or four cities, smaller towns will be introducing sewerage, and your committee feels that a great step forward in the Board's work would be gained if the Board were placed in a position first to gain for itself all the available knowledge as to the methods being adopted elsewhere in working out these problems to a successful issue, and thereafter to give our cities the benefit of such knowledge."

The Report, after discussion, was adopted by the Board. When, two months afterwards, a deputation from town municipalities was received by the Government, and presented arguments and made a request that the Government should undertake some experimental work in the problem of sewage disposal, the Board's Committee, when consulted, naturally strongly urged that such work be undertaken, and that to this end a grant be made by the Legislature for the purpose. This year, as a beginning, a grant of $2,000 was placed in the Estimates, which amount has been more than exhausted by the work carried on by the Board at Berlin.

The following Report on the Disposal of Sewage has been prepared by Dr. J. A. Amyot, Director of the Laboratory of the Board, assisted by G. G. Nasmith, B.A., Chemist, who has aided greatly in the experimental work.

P. H. BRYCE,
Secretary.

REPORT ON SEWAGE DISPOSAL.

By J. A. Amyot, M.B.

To the Chairman and Members of the Provincial Board of Health:

Gentlemen,—Last spring a deputation, representing several urban municipalities, waited on the Government to ask that something be done in the way of experimental work to aid municipalities in the difficult problem they had to face in the disposal of their sewage.

They represented that inland towns were especially interested, that it was difficult to get reliable information with reference to different systems for the disposal of sewage, that this was made more difficult from the fact that different standards of purification were required, that all sewages were not alike, that some towns had manufacturing wastes that were difficult to handle, and that the natural conditions of each town were different, necessitating different procedures in disposal.

The Government laid aside a certain sum of money for investigation along these lines, and called on the Laboratory of the Provincial Board of Health to do the work.

Berlin was chosen as the place to begin in, as there existed there a greater variety of factories giving objectionable wastes than in any other town or city in the Province.

Spasmodic efforts had been made to dispose of its sewage, but with very little success. The sewage, practically untreated, was being discharged into a small creek, which became nearly dry during the summer, so that it became practically an open sewer, and was complained of as a nuisance by those living on the stream below the town. A suit was pending against Berlin on account of this. No other town presented so many problems, and there was none where the question was more pressing. It was accordingly chosen. On March 28th, your bacteriologist visited Berlin to look over the ground and formulate plans for the work. Five days were spent visiting the factories to learn their methods of manufacture and to find what wastes, in what form, and with what intermission, were being discharged into the sewers. The existing sewage disposal plant was also visited and looked over thoroughly. A week later he visited the Eastern States, especially Massachusetts, to investigate the methods of sewage disposal in use there. Three weeks were spent in this work.

On May 2nd, accompanied by the chemist, work was begun at Berlin.

At this time Berlin had at its disposal plant a septic tank of 60,000 gallons capacity, and two coarse gravel beds of 23,000 gallons interspace capacity each. The sewage reached the farm by gravitation. There was a general impression abroad that the sewage, on account of factory wastes, was non-treatable by bacterial methods. The septic tank was being discussed on all hands, and contact beds were the talk of the time. The problems then seemed to be: Is the sewage treatable? What is the value of the septic tank ? What will contact beds do with this sewage ? What is the best material to make these beds of? How large should the material be? etc.

Fourteen acres of intermittent filtration beds, of a poor material, being chiefly clay, were being used. Some of the beds were being cropped. The effluvia about the farm were disagreeable. The beds were in bad repair. The effluent passing into Schneider's Creek was very bad-looking, and of sufficient quantity to render the water quite opaque and blackish in appearance and very offensive in odor.

A laboratory was established in the town in a large room provided by the municipal authorities. They also supplied town water. The laboratory was fitted up by us with tables, plumbing and gas fixtures, and a gas meter. There were many aggravating delays in getting apparatus and chemicals, so that the laboratory was not in running order until June 26th. To test the possible germicidal effect of the gas-works liquor on the sewage, a septic tank of 600 gals. capacity was put in 200 feet above the gas-works, another of the same capacity some two hundred yards below them on a by-way from the main sewer. The cleaning out of the town's septic tank at the farm was begun, also the construction of an 1,800 gal. septic tank, that could be more easily controlled as to flow, etc., than the large town tank. After this, the construction of four contact filter beds was begun to test the value of different sizes of materials and different materials ; to control the capacity, each bed was made independent of the other; and, finally, a continuous filter after the Stoddart model was put in. As the town's gravel beds were found to be completely sludged up, and could not be filled in less than six hours with the means at disposal, they were abandoned as part of the experiment.

On May 27th we were able to start the uptown septic tanks, but not those at the farm until June 25th. The beds (the three gravel ones) were finished later, and put in operation on July 2nd. The coke for the fourth bed did not arrive until August 2nd. The bed was started on Aug. 6th. The cinder continuous treatment bed was put in operation on July 31st.

The experiments were carried on most vigorously until Oct. 4th, when they were discontinued and the laboratory moved back to Toronto, the beds being left in charge of the town's employees to be continued in their operation.

Sewage and Methods of its Examination of It.

In dealing with the problem, the first question naturally arising is, What is sewage? Two kinds are usually spoken of, viz., "Domestic Sewage" and "Manufacturing Wastes." Sewage is the liquid contents of a sewer, made up of human and animal excreta (faeces and urine), kitchen, house, personal and clothing washings, and, in some cases, even street washings. It contains, as a rule, not more than 150 parts of solids per 100,000, or 105 grains in one gallon, and of this only about 55 parts are of organic material, the rest being mineral substance. It is, consequently, not practically burnable as garbage, consisting of old vegetables, dead animals, chips, old paper, rags, etc., would be.

The organic matter is half in suspension and half in solution. The latter, of course, cannot be screened out to burn, and is even more putrescible than that in suspension.

Domestic sewage looks much like dirty dish-water, and contains fatty matter, soap, bits of paper, some rags, more or less finely divided, remains of meat, and vegetables and fruits, starches, sugars, and mineral matter, even wood dust, sand, etc. The organic matter of these substances is variously putrescible, and this by different agencies: fats being by one, sugar and starches by another, and the various proteids yet by others. The mineral matters do not enter into the question, except mechanically. It is this organic matter that has to be disposed of in the various processes of "sewage disposal." The wastes from factories are as varied as manufactured articles are. Even with the same product, as the processes of production vary the wastes vary, as, for instance, in the process of tanning sole leather, shoe-top leather, harness leather, glove leather, etc., are produced.

All these are subjected to different processes. The wastes from all these necessarily should vary, and do vary. The wastes of many factories have mineral matter and organic matter in them. This last is what is to be treated. In the mineral matter there are usually substances which interfere more or less with this treatment.

In connection with the varying composition of sewage, there is variation with the time of day in domestic sewage, even as to composition. In that of the morning, there is more organic matter present, and less at night. Monday is the usual washing-day. Sewage varies thus with the days of the week; but this variation is especially a fact in manufacturing wastes; totally different substances are being discharged into the sewers from hour to hour even, as well as on different days. Sunday is a free day usually. All these changes and variations have to be taken into consideration in any plan of disposal adopted to get anything like uniformity of treatment.

On the whole, wastes originating from animals and their tissues, though more objectionable and harmful, are more easily disposed of than the wastes from vegetable life. Organic matter may come from diseased animals, and may thus convey disease. The excreta from healthy individuals may give rise to sickness. This organic matter putrefies, giving rise to odors that are objectionable and injurious to health, and in this process of putrefaction gives rise to poisons. Organic matters, other than animal in origin, that are putrescible, may also give rise to more or less poisonous substances. Hence discharging sewage into drinking water, either for man or animals, is objectionable, and to be avoided if health and life are desired. Putrefaction, rotting or fermentation is Nature's method of getting rid of all this organic substance. When this process is complete, nothing is left but mineral matter. It is objectionable in the intermediate stages. No sewage is completely purified so long as there remains anything in it that is putrescible.

Sewage disposal is then really the mineralizing of organic matter. This is done in Nature by the agency of those minute microscopical vegetables, the bacteria. Practically no putrefaction takes place without the agency of these microbes.

Methods Used to Arrive at a Discovery of the Composition of Sewage.

Gauging the Flow.—This is as important as to know the quality of a sewage in order to arrive at an estimate of the amount of plant required to treat a given sewage. The flow varies at different hours or on different days, and at different seasons. The dry weather sewage is the usual standard to go by, because it gives more nearly the organic strength of the sewage, and this is what is treated. The sewage in wet weather is subject to so many variations that it is difficult to measure the amount of water diluting it, since the rainfall varies greatly. A light, though continuous, rainfall may give the same amount of water as a sudden summer shower, but will affect the sewers quite differently. One will flood them out; the other will sink into the earth, and, perhaps, not add much to the sewer contents. The dry weather sewage, since this is usually in the summer months, has also another aspect, especially in inland towns, viz., the carrying away of the sewage by smaller and smaller stream flows, thus giving rise to more and more nuisance. Direct measuring with measures of known capacity in a given time is a simple method where the flow is not too great, as, for instance, a hotel or institution, a small hamlet, etc., and is sufficiently exact, provided reasonable care be taken with the time and the accurate filling of the measure, and the measurements be taken over a sufficient period of time. For large quantities, as in cities or towns, weiring of the main sewer is the simplest method, and accurate enough. This consists in causing the whole flow to pass over a sharp-edged horizontal right-angled dam or weir of known height, and measuring the depth of fluid over the weir at intervals to get an average, at the same time using weighted floats to learn the rate of flow.

With these data, viz., the length of weir, the height of fluid flowing over the dam, and the rate of flow in a given time, there is no difficulty in arriving at an estimate, at least of the flow in the twenty-four hours.

Taking Samples for Examination.—To be accurate, these should be taken at frequent intervals (half-hours or hours), and always in a quantity corresponding to the flow at the time of taking. There is not always time to do this, nor is it always possible to get labor sufficiently intelligent to make such varying quantity collections, so that it is usual to collect a stated quantity at regular intervals. These are poured into a large bottle or receiver, and kept in the cold, ice being used if necessary, until carried to the laboratory. The examinations are made from aliquot portions of this. It is hardly necessary to mention that the greatest care should be taken in having all receivers "chemically clean." Decimal parts in a hundred thousand are being dealt with.

Terms Used in Speaking of Sewages.—The term "raw" is used for sewage as it leaves the house or the factory, and "stale" is such as has been in the sewers some time, and has undergone some changes, evidencing this in its acquired odors and changes in appearance, and is such as is found at the outlet of a main sewer. "Septic" is a sewage that has undergone a considerable anaerobic bacterial change. "Affluent" is the sewage of whatever character going into or on to any sewage disposal plant. "Effluent" is sewage as it passes out of this apparatus, whether a screening chamber, a septic tank, or a treatment bed of whatever kind.

Temperature.—This is taken of both the "affluent" and the "effluent." It is one of the gauges of the treatment or chemical changes taking place in the apparatus. Chemical changes are accompanied by changes in temperature. In the case of a sewage disposal apparatus, allowance should always be made for the surrounding temperature, warming in summer and cooling in winter. Sewage does not freeze as quickly as pure water, nor does it, when frozen, form as solid ice water does.

Turbidity.—Under this heading, the sediment and the scum are chiefly taken note of. As the scum may be fat, oil, tar, or wood fibre, this has to be taken into account, from their behavior in reference to treatment of bed surfaces. The sediment is gravel, or what? This is dried and the weight for quantity estimated; then incinerated for estimation of the volatile or organic substances, and the mineral remains, or ash. This gives an estimate of the amount of the total organic matter to be treated, without reference, of course, to its quality, and is usually slightly over one-third of the total solids. Another estimate is made with the scum and sediment, viz., the quantity of matter in suspension and in solution. Both of these dried show the total of each. When incinerated they show the organic and the mineral matter in each.

Usually about half of the organic matter in a sewage is in solution, the rest in suspension. The variation in the mineral matter is greater. Sometimes less than half is in solution, generally much more than half. The microscopic examination of the sediment is sometimes of considerable value, as showing vegetable and animal remains present, aside from living plants and animals.

Color.—This is of the greatest value in telling us what is coming down with a sewage and as indicating when certain substances are coming; since, especially when there is much manufacturing waste, there is much variation in the quality of a sewage from hour to hour. The red-brown color of tannery waste may be taken as an example of this, or, again, the presence of certain dyes. Where "selective" methods of treatment are in use this is especially of value as indicating when to treat one portion and when another. These colors have to be noted and learned for each sewage, because two combinations are rarely alike.

Changes of Color.—These in a sewage in process of treatment are worthy of note also. For instance, at Berlin, during our experiments, the first indication of septic action in the tanks, and afterwards of oxidation in the beds, was shown in the changes of color undergone by the tannins of the sewage. When all the tannins are not removed in an effluent, and it enters a stream, no reaction may be produced; but, as happened in Berlin, a valuable indication was given of the presence of iron in the receiving creek, by the immediate blackening of the water and effluent mixture.

Odor.—Stale, septic and treated sewage have their own odors, and these with any given sewage may be useful in indicating what is going on in it. The effluent from a sewage disposal plant should have either no odor at all or only a slightly earthy one. Anything else shows deficient or incomplete treatment.

Reaction.—Sewage is generally neutral. It may be alkaline or acid. In chemical treatment, it is essential to know this, e.g., when lime is the treating material, if the sewage is neutral or alkaline, the lime that will be used will be all towards precipitation; if the sewage be acid, enough will first have to be added to reach the neutral point, then more added for the precipitation. More efficient treatment can be done in this manner, for an excess of lime does not mean more treatment, beause some of the organic matter is redissolved in an excess. Watching the reaction conduces to economy also. Two indicators are used, phenophthalein in solution, producing a bright red in alkaline substances, and blue litmus in solution producing a red color in acid solutions. The solutions are kept in "drop-bottles," and, when required, are sprinkled on the sewage as it passes, giving distinct color reactions.

Gases Produced.—There is a movement at present to make this a test of the working of a sewage plant, especially in the septic tank department of it, from the fact that in this test a great deal of the organic matter is converted into gas. It is certainly valuable, but other compounds are formed as well as gas, being a sort of priming or formation of simpler compounds from the organic matter which will later be more easily oxidized when they reach the oxidizing beds proper. These gases can readily be gathered by just sinking below the surface of the sewage the mouth of a large funnel, to the spout of which is a tube carrying the gas into a proper receiver. The usual gases gathered are CO^2, CH^4, C^2, H^4, CO, H^2 and N^2, H^2S, or $(NH^4)^2$, S may be present, and, perhaps, others; also ammonia is left in solution.

Free Ammonia.—In perfectly fresh sewage this, except accidentally, is not present; but the substances out of which it is formed by a process of hydrolysis in the progress of fermentation are. Of these, urea, one of the chief nitrogenous constituents of urine, gives origin to most of it. Higher nitrogenous organic compounds also give rise to it in the process of their decomposition. Ammonia is very soluble in water, and, consequently very little of it escapes into the air. The quantity of this gas present in a sewage or a water is an estimate of the nitrogenous organic matter already decomposed. Its presence is shown by treatment with a standard solution of the iodide of mercury (Nessler's solution), and .008 mgm. of ammonia in 50 cc. of water can be shown by this method. The process is called Nesslerizing. It is a colorimetric method, and depends on the comparison of the solution in question with a series of standard ammonium solutions, treated by the same agent (Nessler's solution). The color is a yellowish brown. In the examination a fixed quantity of the sewage is taken. It is usually necessary to dilute this with water—(of course, distilled ammonia free water is necessary)—generally one in fifty parts. It has been recommended to examine, without any further preparation, in 50 cc. Nessler tubes. However, it is usual to distill off the ammonia by boiling. This is said to alter the organic matter present, but hardly seriously. The free ammonia usually comes off in the first 150 CC. of the distillate; what sewage is left in the flask is then treated to obtain the albuminoid ammonia.

Albuminoid Ammonia. It is no special form of ammonia. It is simply ordinary ammonia, obtained from a water or sewage by a chemical decomposition of the not yet completely altered, or the unaltered albuminous or proteid matters present. This albuminous substance constitutes the greater part of the nitrogenous substances present in a water or a sewage. It is probably the most important substance, estimated by ordinary laboratory methods in water or sewage examinations. It is this proteid portion of a sewage that gives rise to most of the trouble experienced from the pollution of a water supply. It is chiefly on the percentage removal of this albuminous constituent that an estimate of the efficiency of any sewage disposal plant is made. It is computed by estimating the quantity of ammonia recovered by distillation and Nesslerization after the decomposition of the albuminous substances by the action of a strongly alkaline solution of permanganate of potash, with the application of heat.

Oxygen Consumption.—This is, after the albuminoid ammonia, the next most important estimation made in the examination into the quality of any given sewage. It represents the proteids plus the carbonaceous materials of the organic constituents of the sewage. It simply represents what is oxidizable in a sewage. Instead of using free oxygen, which would be difficult to handle, there is used a substance, permanganate of potash, which contains a fixed quantity of oxygen, that it will give up when in reaction with organic substances. There are organic substances which this process will not reveal, and also mineral substances with which it reacts; but, in spite of this, and this is only a very small source of error, it is a very valuable point in the estimation of the constitution of a sewage, and again in estimating, by the disappearance of the substances which give rise to the reaction, the value of a disposal system. In procedure, the permanganate is made into an accurate standard solution. The sewage is taken in a fixed quantity, and boiled with a solution of sulphuric acid, and then treated with an excess of the permanganate solution, while boiling gently, for three minutes. Sometimes the estimation is made in the cold, using hours instead of minutes. Each has its advantage. The three minute method is most frequently used in laboratories. This is then decolorized with an oxalic acid solution, which also is a carefully standardized one, and again titration with the permanganate solution is done until a permanent pink color is produced. The oxalic acid corresponds to a certain quantity of permanganate of potash. This is estimated, the remainder of the permaganate used represents how much oxygen has gone into the organic matter of the sewage. This is what is meant by oxygen consumed.

Chlorine.—This is estimated by titration against a standard solution of nitrate of silver, using chromate of potash solution as an indicator. It represents chiefly the common salt present in the sewage. When not used in manufacturing processes it is chiefly from the urine, and allowance must be made for the kitchen as a source of it. In sewage examination, it is not of so much value as in water analysis. It's chief use in sewage examination is as a measure of dilution, especially when the effluents enter small streams. For instance, if the chlorine contents of a stream above a sewer inlet is known, and the chlorine of the sewage entering is also known, by examining the mixture far enough below the sewer entrance to permit of thorough mixing, a very accurate estimate of the dilution is found.

Chlorine is not materially removed by treatment. It is usually present as sodium chloride or common salt, in solution, and is a harmless mineral compound.

Nitrites and Nitrates.—These are the end products in the treatment of the nitrogenous substances of the sewage, where part of the treatment is oxidation. In the management of sewage treatment beds, these are taken as the evidence of efficient oxidation in the beds. In one of the overworked town beds in Berlin, on examining the effluent, no nitrites or nitrates were found, and all the albuminoid material was removed. Free ammonia was found in very large quantity. A complete septic tank treatment had taken place, with no oxidation of the ammonia produced.

In septic sewage no nitrates are found, but occasionally a trace of nitrite.

In examining for nitrites their presence is shown by a colorimetric method, with an acid solution of metaphenylene-diamine, against standard solutions of sodium nitrite in Nessler tubes.

In examining for nitrates, we have been in the habit of using electrolysis, by means of a zinc-copper couple, to decompose nitrites and nitrates into ammonia, estimating this, subtracting the original free ammonia content of the sewage, and also the quantity corresponding to what nitrite has been found by the previous method. Then, by converting the ammonia formula into free nitrogen, we express the result as nitrogen present as nitrates, without any reference to the form found. When we have added the free ammonia, the albuminoid ammonia, the nitrites and nitrates together, we have the greater part of the nitrogenous compounds of the sewage accounted for. The remainder is of such a kind that it is with the greatest difficulty decomposed. It is often found in beds where active oxidation is going on, that the albuminoid ammonia in the effluent is in greater quantity than was present in the affluent. It is probably out of this remainder that, by oxidation, the additional albuminoid ammonia is formed. This very stable nitrogenous substance is now converted into such albuminous substances as are capable of being converted into ammonia by the action of the alkaline permanganate of potash solution used.

The presence of this remaining nitrogen may be shown by the Kjeldahl method, which, by the action of continued heat and strong sulphuric acid, converts all the organic nitrogen of the sewage into free ammonia. This is then estimated, after neutralization has been accomplished, with 25 per cent. sodium hydrate solution by nesslerization. The original free ammonia is subtracted; the remainder represents the albuminoid substances, the nitrites, the nitrates and this above-mentioned nitrogenous remainder, and is all classed together and called the organic nitrogen of the sewage.

Bacteriological Examination—The ultimate decomposition or disposal of a sewage is by bacteria, whatever method of disposal we adopt. There are numerous varieties of them. There are varieties, probably, for the decomposition of each of all the organic compounds found in a sewage; some for each sugar, each starch, each fat, each proteid, and so on, divided into two great classes. The anaerobic bacteria are those performing their function in the absence of oxygen by a process of hydrolysis, while the aerobes are those requiring oxygen for the performance of their function by a process of oxidation.

The bacteria are gathered up by the sewage from all directions. Bacteria are practically omnipresent. In a plant where septic tanks are used, the conditions favoring the anaerobes are present, a process of selection by circumstantial surroundings takes place, and the anaerobes thrive. The aerobes are not killed out, but are simply rendered dormant, as it were. When the effluent passes from the septic tank on to an oxidizing bed all the conditions are present for a free supply of oxygen; the anaerobes become dormant; the aerobes now thrive, being selected in turn by their circumstantial surroundings. The chief bacteriological examination made in sewage work is counting the bacteria in a given quantity of a sewage. One cubic centimetre is the standard quantity. This is with the object of finding the nutritive value of a sewage. The more rich in organic matter, the more will such a liquid support. As sewage passes through the successive parts of a disposal plant, the number becomes less and less, until finally we count them in thousands only in a good effluent, whereas in an ordinary stale sewage we may find as many as 15,000,000 to 30,000,000 to one cubic centimetre of fluid. The counting of the bacteria has another object, and this is especially the case in dealing with manufacturing wastes. It is to see if the particular sewage is inimical to the growth of bacteria, and as to whether it is consequently in its present state a treatable sewage by the bacterial method, or of finding if by some special process of handling it might not later be made into a treatable material for the bacterial method, the ultimate one in any case.

Bacteria crowd each other out; but it is still a question whether pathogenic, or disease-producing, bacteria are killed out in a sewage disposal plant. The nearer the effluent from the plant is to pure water, the less it will support these bacteria, and the sooner will it ultimately starve them out.

Bacteria from sewage are counted by a process of plating with a favorable medium for the growth of the bacteria. It is necessary in most cases to dilute. This is usually done in water previously sterilized. By experiment, the dilution is got down to where not more than 250 or 300 bacteria are contained in one cubic centimeter of the diluent. Many colonies growing on a plate of culture-medium inhibit each others' growth. The growths are usually made at 18 to 22 degrees C. of temperature, and under aerobic conditions only. This, of course, is error in the case of septic tank contents. These must be grown under anaerobic conditions, but such are extremely difficult and awkward to maintain. The more complicated a method, the more the chances of error to creep in are, and on account of this anaerobic cultures are not frequently made.

Degree of Purification Required of a Good Disposal Plant.—The ideal of course, is pure water, such as could be used with absolute safety as a drinking water. This is not possible by any of the methods now in vogue. The intermittent sand filtration method has come the closest of any method to this goal. No person has been found daring enough yet to recommend even this sand effluent as a drinking water, though from a chemical standpoint, much worse waters are habitually drunk without harm. In the case of a sewage effluent, though, we are dealing with something that is removed from pure sewage by too small a margin. We cannot yet be assured that pathogenic bacteria have all been killed out in the passage of the sewage through the beds.

Nature has her methods of purifying polluted waters. Water-courses are depended on for drinking water. It is in these where Nature does her work. She needs time, though, to do it. When too much to do is put upon her, she simply deals with what she can and passes the rest on. Is a city or town at that point on a stream or river where she is passing the work on to be gone at later? This city or town, if it attempts to use the stream or river water as a drinking water, gets unaltered, or nearly unaltered, sewage, and we know this means typhoid fever, diarrhoea, etc., etc. So that now, when we consider the work a sewage disposal plant will be required to do, we shall have to think of the requirements of the stream receiving the effluent. Is the water to be used for drinking purposes, either for man or animals? It is as necessary to have good water for animals as for man, because animals used as food by man must be in sound health to become good food, and if they drink sewage water, we cannot be sure that they will be in good health. Where much dilution can be obtained, the sewage is soon rendered nearly harmless. Is the water body a running one or, like a pond or lake, a comparatively stagnant one? Mixing does not take place quickly under these circumstances. Then, how far below the outlet is the water used for drinking purposes?

When a water reaches that point where it is to be used for drinking purposes, chemically it should not have more than .005 parts of free ammonia, or .023 parts of albuminoid ammonia, or .740 parts of oxygen consuming material to each 100,000 parts of the water. When this is taken into account, with a small stream receiving much sewage, the requirements from the sewage disposal plant are great. For instance, a disposal plant emptying its effluent into a stream which during dry weather does not send more than three times more water than sewage, would have to show such an efficiency that at least not more than .015 parts of free ammonia, .069 parts of albuminoid ammonia, and 2.220 parts of oxygen-consuming material per 100,000 be found in its effluent, and that this be non-putrescible.

If the stream, at its smallest capacity, were larger, say, sending for dilution ten times more water than sewage, then the plant's efficiency could pass whilst allowing .05 parts of free, .230 parts of albuminoid ammonia and 7.40 parts of oxygen-consuming materials to pass into it.

In the Eastern States, if the flow equals fifty times the quantity of sewage, the sewage is allowed to pass with a less complete treatment into the stream, but always with a protest, especially if a town is situated at a short distance down stream taking water from this source. It is difficult to set up a general standard; each case must be taken by itself, and, from circumstances, a standard made for it, always keeping in sight the fact that no drinking water should have more, under ordinary circumstances, than .005 parts of free ammonia, than .023 parts of albuminoid ammonia, and than .740 parts of oxygen-consuming material per 100,000 parts. A really good water would contain near what a Lake Superior sample would show, viz., of free ammonia .003 parts, albuminoid ammonia .005 parts, and oxygen-consuming material .115 parts per 100,000. It is to be understood that the effluents spoken of must be practically non-putrescible when entering the stream.

Fixed standards for purification have been made. For example, the Mersey and Irwell Joint Commission class as good an effluent, which absorbs less than .142 parts of oxygen and which evolves not more than .142 parts of albuminoid ammonia per 100,000.

The Inspector of the Ribble Joint Commission classes as good an effluent if the albuminoid ammonia liberated is below .1 part in 100,000, provided suspended matter is absent and the presence of nitrates is confirmed.

The Derbyshire County Council defines a good effluent as one which contains less than .1 part per 100,000 of albuminoid ammonia and which contains more than .5 parts per 100,000 of nitrogen as nitrates, and one which subsequently does not undergo putrefaction.

The oxidizable matters from factories not dealing with animal substances are often not harmful; in fact, in many cases, are not even putrescible, so that standards must be flexible.

On the whole, the Irwell Joint Commission's standard for an effluent is the one generally accepted, viz., .142 parts of albuminoid ammonia and .142 parts of oxygen consumed per 100,000 parts, provided it is non-putrescible in a week.

Constituents of Sewage.—Organic matter may be conveniently divided into three classes—carbohydrates, fats and proteids. These substances, in Nature are decomposed bacteria, and probably each compound has its own decomposing variety of bacteria.

The carbohydrates, such as cellulose, starches, and sugars, as also alcohols, certain organic acids, as lactic, acetic, etc., are acted on by microbes, sometimes converting them directly into gases, such as hydrogen, carbonic acid gas, methane, e.g.:—

(Cellulose), $C_6H_{10}O_5+H_2O=3\ CO_2+3\ CH_4$ (methane)

or by a more gradual method, forming intermediate compounds, each simpler than the original, and the former, gases being disengaged, until finally all is converted into gas and is diffused into the surrounding air, e.g.:—

(Starch), $C_6H_{10}O_5+H_2O=C_6H_{12}O_6$ (sugar)
(Sugar) $C_2H_{12}O_6=3\ CO_2+3\ CH_4$.

Or the sugar may be converted into alcohol and carbonic acid, the alcohol in turn into aldehyde and water, this last into acetic acid, and this even into formic acid, and this finally into carbonic acid and water. In this way the original substance is gradually reduced in quantity, and finally all goes into the air. These processes take a very short time, twenty-four hours, or even less, under favorable circumstances, is enough for their accomplishment.

The fats are also decomposed by bacteria. This is why fats become rancid. Fatty acids are set free. Of these, some combine to form soaps with any free alkalies that happen to be present in the sewage or surroundings; others are further simplified by oxidation, and may finally be completely gasified. The glycerine that is left is soon decomposed into gases. The soaps are decomposed, and further changes take place in them until finally all the fat, step by step, is gradually removed. The process is more tardy than that dealing with the carbohydrates, and we will see later the effects of this in the treatment of sewage and in the handling of the disposal beds.

There are also proteids and proteoids, including the various albumins, myosins, gelatines, keratins, and such nitrogenous derivatives, as albumoses, lysins, lecithin, creatins, tox-albumins, ptomaines, leucin, tyrosin, glycin, urea, indol, skatol, etc.

This last class makes up the nitrogenous portion of organic matter. It is the part directly coming from living tissues. There substances are highly complex, and of the organic substances this division is the most important. It is the portion that gives rise to the most disagreeable and noxious odors and to the many poisonous products that are derived from putrefying organic matter, e.g., in canned meat and game and fish poisoning. As the bacteria which decompose these complex substances are varied, their products are also varied. The gases produced from these substances are ammonia, nitrogen, carbonic acid, carbon monoxide, oxygen, hydrogen, and ammonium sulphides, and various very offensive aromatic gases, e.g., thio-alcohols, mercaptans, phenols, etc. The production of these gases is varied by, apparently, at least, very trivial circumstances, e.g., little differences in temperature, reaction of medium, slight changes in composition of media, etc. These conditions are not all known. Bacteria are present practically everywhere. Nothing we touch is free from them. If the tissues of fruit or animals are injured or killed, and these bacteria can gain access to the affected parts they immediately begin the process of disintegration. The result of their work is the removal of so much now useless organic material in its original form. Gases are formed which go off into the air, while the remainder is liquefied; other compounds are formed and again other gases. So the process goes, until finally there is practically nothing left but the mineral matter. This is Nature's method of getting rid of useless organic and encumbering matter. These gases are not wasted, for they are taken up by plants, and again by a step after step reversal of the process taking place, the elements are brought back to living tissues, gases and minerals to plants, plants to animals, animal tissues back to gases and minerals, and so the cycle is completed.

Now, in sewage disposal all these processes are brought into action in the ideal method. The organic matter is decomposed, the products form food for plants, the plants form food for animals, and so around again. The complete process, that of land-irrigation for crop-raising is under some circumstances, though desirable, a too expensive method. We are then satisfied with gasifying and mineralizing the matter, thereafter discharging it into water-courses, and allowing it to become food for water plants, and these to feed fishes, which are returned to us as food. It is often said that it is wasteful to cast this refuse into water-courses, and thence into the sea. This plant and afterwards fish-feeding phase has been overlooked.

In sewage there is fertilizing material; but it is present in a relatively small quantity. The process of separating it in any quantity for this purpose may be too expensive. There are much cheaper methods of getting the same amount of nutritive material for plants. The idea prevalent of being able to make money out of sewage disposal by any of the present methods has been responsible for a great deal of misunderstanding, and has been a hindrance to sewage disposal as a principle.

Methods in Use to Dispose of Sewage.

Various methods are in use for the disposal of sewage. They all have good points about them, and some bad ones also. None of them is perfect. Most of them are based, though, at one time this was not known, on the action of bacteria for their success, and, of course, the methods that give the most favorable circumstances for their growth give the best results. Other methods are used, e.g., chemical precipitation, but ultimately bacteria are called on, even here, for final removal. This method is simply temporizing. One method is applicable to one place, another to another, according to natural advantages or disadvantages existing at the place of disposal. Some places have sand, some have not; some can use gravity to carry sewage, others have to pump; while some have plenty of space, others have it contracted. Such methods as the following have existed:

(a) The Indian moves away when an encumbering amount of sewage accumulates, and pitches his wigwam elsewhere.

(b) It is thrown on the soil in the back-yard. A great part of it sinks into the earth, and so long as it can filter through and run away to give a chance for the next deposit to do the same all may be well. But unfortunately the land, as a rule, soon becomes water-logged; the water, with its contained sewage, is retained, and soaks further and wider into the earth, and if a well happens to be close at hand, enters into it. Now, this water-logged earth forms a continuous medium for bacteria to grow in, and, if by misfortune, disease-producing organisms happen to reach this soil, they will have a fair chance, through this continuous water stratum, of reaching the well to be drunk with the water. And even though disease organisms do not penetrate by this process, organic matter in solution getting into a well gives food material for bacteria, if any should be present. An ideal pure drinking water is one that contains so little organic matter, or the derivatives of it, that it is unsuitable as a food material for microbes. The organic matter in a water is chiefly harmful from the fact that, on account of its nutritive quality for microbes, it may encourage their growth. Bacteria falling into pure water through dust, from drippings from well-tops, etc., may be killed out in a few days; but if the water have organic matter in it, and this only in decimal parts, even in a million, the bacteria thrive and multiply rapidly, and if they be disease-producing ones, produce disease in those drinking it. There is another objection to this system, viz., the odors emanating. These may be only disagreeable, but, unfortunately, many of them are harmful to health; not of themselves producing disease, but are auxiliary to some "efficient" cause in that they lower the general health and vigor of the body. One would think, when passing through the country, from the filthy appearance of yards and barn-yards, that our farmers had come to the conclusion that it was good for their cattle and them selves to have these odors about. They drink bad water and smell bad odors, and they suffer for it, though they should be the healthiest people in the land.

The difficulty underlying this method is that, from a small piece of land much more work than can be done by its bacteria is expected. What the land cannot treat accumulates. The bacteria, overfed and then bathed in their own products, are killed out, just as the acetic acid in vinegar production, when it reaches a certain percentage, at first checks and then kills out the acetic acid bacilli. Now, if circumstances become favorable, e.g., the temperature increases, dry weather comes on, or drainage is brought about, the bacteria grow again, and bad odors commence. If the conditions continue favorable all the organic matter may thus be got rid of. We shall find later that the principle has its application in the periods of rest given to working filter beds.

(c) Discharging Sewage Into Water Courses.—Here, again, we depend on the action of bacteria for the removal and treatment of organic matter. These bacteria are present in the water, being carried in by the sewage. But the sewage undergoes certain changes, aside from the action of bacteria, from admixture with the water. The brown waters from north of Lake Superior lose their color in a very short time after reaching the lake. The lime and other salts in the lake and bay water, or those in the river water, along with the active oxidation which goes on from the great quantities of oxygen dissolved in the waters of these great bodies, quickly precipitate it, while at the same time it carries to the bottom by gravity with it suspended particulate matter. Here it is attacked by anaerobic bacteria, and is either completely gasified or liquefied; a process of hydrolysis taking place. A molecule of water enters into that of the compound, disruption takes place, and simpler compounds are the consequence—thus:

(Albumen) $4\ C_8H_{13}N_2O_3+14\ H_2O=4\ N_2+19\ CH_4+13\ CO_2+2\ H_2$.
(Urea) $CO\ (NH_2)_2+H_2O=CO_2+2NH_3$.
(Cellulose) $C_6H_{10}O_5+H_2O=3\ CO_2+3\ CH_4$.
(Starch) $C_6H_{10}O_5+H_2O=C_2H_{12}O_6$ (sugar).
(Sugar) $C_2H_{12}O_6=3\ CO_2+3\ CH_4$;
Or, $C_2H_{12}O_6=2\ CO_2+2\ C_2H_6O$ (alcohol).

Thus the matter is reduced in quantity; the liquefied portion may be reprecipitated and again acted on by the bacteria, while other portions of it are oxidized. By the intervention of aerobic bacteria, the organic matter by the ferments which the bacteria form, is put into such an unstable condition that it takes up the free oxygen presented to it. By this entrance of the oxygen into the compound, changes are brought about in it; new combinations are formed, the original molecule is disrupted, while from a complex molecule more or less simple ones are formed. Thus:—

(Albumen) $C_8H_{13}N_2O_3+19\ O=8\ CO_2+6\ H_2O+N_2+H$;
Or, (Ethylamine) $(NH_2)\ C_2H_5+HNO_3=C_2H_5OH+H_2+N_2$ (alcohol).
(Alcohol) $C_2H_6O+O=H_2O+C_2H_4O$ (aldehyde).
(Aldehyde) $C_2H_4O+O=C_2H_4O_2$ (acetic acid).
(Acetic ac.) $C_2H_4O_2+O_3=CO_2+H_2O+CH_2O_2$ (formic ac).
(Formic ac.) $2\ CH_2O_2+O_2=2\ CO_2+2\ H_2O$.

It must not be understood that these are the exact compounds or the only ones found, since many others may be found. Various bacteria have the power to form each their own compounds and combinations. In these processes such acids as nitrous and nitric are found. These combine with bases, as lime, sodium and potassium in the water, and form, the nitrous acid, the nitric acid, with nitrates, the end-products of nitrogenous compounds. Ordinary water at the point of saturation holds only 7 cc. of oxygen to each litre, which is soon used up.

When much sewage is being decomposed, a great deal of oxygen is required for these oxidation processes. This part of the process ceases when the oxygen fails. In Nature it is supplied to the water by its exposure to the air through agitation by the wind, through running over rapids and over rocks, through currents produced by heat unequally distributed, as by shade and light, and chemical changes taking place deep down, thereby producing heat. When too much sewage is present in the water, all this dissolved oxygen is used up. Fishes depend on this oxygen for their respiration. They are driven out of sewage polluted waters when it has reached these proportions, or, if forced to stop in it, they die. Thus, the power of fishes to live in a water is taken as a test for its purity. When they do not live in it, we have undoubted proof, other circumstances being excluded, that the water is seriously polluted. Yet, unfortunately, though pollution may not be great it may yet be dangerous, though fish may live. Hence this method decidedly has its limits. In a river or lake all these chemical actions go on, precipitation, from admixture of water and sewage, these containing varying compounds, hydrolysis and gasification of this by anaerobic bacteria. What is left is oxidized through the agency of aerobic bacteria, the oxygen for this purpose being derived from the air dissolved in the water. Other agencies besides these play a part in the process, and they have probably not been heretofore taken sufficiently into account. Thus plant life of a slightly higher order than the bacteria, and even those low forms—so large that they are quite visible to the naked eye, as a fur-like growth adhering to higher water plants and to stones and bits of wood—perform their part in precipitation. The meshes of the low plants give shelter and protection to myriads of chlorophylaceae, and to many forms of protozoa (paramecium, monas, euglena, vorticella, stentor, etc). These plants and low animals are found not so much when the sewage is fresh or just stale, but when it is partially treated. Old cess-pools show them in large numbers, especially the protozoa. Continuous filters and the drains from filter-beds also show them in large numbers, but especially do they show the low vegetable organisms. These at times form veritable nuisances, by growing to such an extent as to fill up the drains, etc.

Various standards of dilution of sewage with river water have been attempted. The difficulties are: (1) The variation in the compositions of the sewage, e.g., English sewage is, as a rule, 3 to 4 times as strong as that met with in America; that of Berlin, Ont., is over twice as strong as English sewage. (2) The variation in rate of flow of rivers. (3) The variation in the quantity of water at different seasons. When the free ammonia does not exceed .12 parts in 100,000, the dilution is looked on as a safe one. In the Eastern States this would correspond to a dilution of one part of sewage in 50 of water; in England, with the sewage three to four times this, the dilution would need to be one in 150 to one in 200; and at Berlin, Ont., to be on the safe side, one in 500 of river water.

There is a very important objection to discharging sewage into rivers to be sent down to towns and cities below, owing to the fact that sewage may run quite a long distance before mixing intimately with the water and being diluted and treated.

The same thing applies to the discharging of sewage into large bodies of comparatively still waters, like Lake Ontario. Sewage may float on the surface for long distances, and be carried in various directions according to the winds. Off Toronto Island this is well illustrated. On one day floats will be seen drifting eastward, and a few days afterwards westward. These currents and the fact that sewage shows a tendency to flow near the surface has an important bearing in reference to water supplies to towns on lake fronts where raw sewage is being discharged into the lake. Experiments carried on some years ago by the Provincial Board and Toronto officials showed that on certain days floats would travel from off Scarborough Heights to the western end of Toronto Island, a distance of about six miles, in some cases in three hours. The sewage could not be decomposed in this time.

(d) Land Irrigation.—The first systematic attempt to dispose of sewage on a large scale was made by this method. Large cities like Paris and Berlin had outside their confines extensive tracts of almost barren sandy lands. These lands only needed water and fertilizers to make them productive. These cities were polluting their water supplies with their own wastes. This method of irrigation, as a method of disposal, proved so successful that Berlin irrigates some 11,000 acres of such land, and is extending the system to 19,000 acres.

A daily average of some ten thousand gallons of ordinary domestic sewage can be disposed of to the acre by this method on a suitable soil. The best soil for the purpose is a sandy loam, the more sandy the better, and well underdrained, usually at a depth of four feet. Plants take up a large quantity of water from the soil. It is calculated that for every one part of dry solid added to the weight of a plant 250 parts of water are evaporated. But all the water in broad irrigation is not got rid of in this way, but partly by underdrainage. The importance of a porous soil is quite evident when this is taken into account. The more clayey and heavier the land is the less will water drain off, so that if broad irrigation is adopted, where such heavy land only is procurable more must be utilized and very much less fluid applied to the land. All plants are not suitable for growing on such beds, but only such as can be grown on ridges or stand up from the earth are safe to be used as food. The sewage must not touch the plant in its raw stage; this usually injures the plant or may kill it. The plants are placed in beds or ridges, having trenches running around or alongside, in which the sewage courses at intermitting intervals, filtering through the earth, laterally, a good deal of it, of course, sinking down into the earth. Plants cannot use raw sewage, except in very limited amounts. By this method of distributing the sewage, bacteria in the neighboring soil oxidize it, and it is then taken up with the water which the plants absorb from the earth. Now, plants cannot be loaded day after day with large doses of water. The requirements of the plants by this method come first, and the sewage supply must be limited to these. If there are other beds, and it is always necessary to have plenty of reserve land where this method is used, the sewage is sent to them; if there is not, it must be cast away without treatment. In Berlin, Germany, where this method is possibly seen at its best on the Continent, they have found it necessary to separate the heavier portion, or the sludge, of the sewage, before allowing it to go into the trenches, from the fact that in a very short time this sludge coats over the surface of the trenches and obstructs the filtration into the land, and, from covering the surface, prevents the free access of oxygen into the soil, thereby crippling the action of the aerobic bacteria. Under such circumstances, the effluent from the underdrains is found to carry off a still putrescible, or a more or less incompletely treated and putrescible substance—a poison-carrying material.

At the Asylum for the Insane, at London, Ontario, probably the best broad irrigation method of sewage treatment on this continent is carried on. Heavy crops of varying kinds of vegetables are grown, several crops on the same land being produced in the one season. The sewage is the domestic sewage of the institution, where there are over 1,200 inhabitants, giving about 75,000 gallons per day. This is collected in a large reservoir and pumped out once a day, a special form of steam blower, devised by the engineer, being used to stir up the sewage so that all the sludge is carried off at each pumping. This is distributed to the long beds in lateral ditches or trenches of 6 feet wide, between flat beds 12 feet wide. The land is coarse sand. From the trenches the sewage filters laterally into the vegetable beds. There are seven acres for the treatment of this sewage, and the long beds are centrally underdrained throughout their length. The sludge that collects in the ditches, as soon as it dries, is raked up and carried away in barrows, and this has to be done occasionally, every two or three weeks. The trenches are spaded over three or four times in the year. When more water than ordinarily is required by the plants, and they are of a kind around the roots of which the sewage can be poured, the sewage from the trenches is ladled out. All this, of course, means a good deal of labor. Here it is useful labor in the treatment of patients, and practically costs nothing. They have found that it is necessary to use manure as well as the sewage to get the best results from their gardening, and this in spite of the fact that it is a fairly strong domestic sewage. There is no bad odor about the place, and no complaints are made from the lower lands. In fact, it is admitted that the crops in the fields below have been better since this system was adopted. During the winter months, the sewage is run into the trenches as in the summer, and disappears nearly as quickly, and has given rise to no complaint. The snow, when there is any in the trenches, is dug out before running in the sewage, otherwise they have found freezing takes place to such an extent as to prevent filtration. They leave the snow in the trenches between times to keep the ground from freezing deeply. There are some ten trenches, fully 500 feet long. All the sewage of a day is run into one or two of these and then into the next one or two on the following day, and so on, leaving the first to rest until their turn arrives again. On a recent visit, the trenches had been filled a couple of hours before my arrival. The distal ends were already dry and at the proximal ends the sewage had nearly disappeared. The ground was only moist. These trenches would get nearly five days' rest before the next application. Each trench had got, with this charge, about 37,000 gals. If it were required, more sewage might be treated here by giving three days rest, on account of the great porsity of the soil and the great care that is taken to keep the surface in such good condition. Land will not treat all it will filter, as is sometimes supposed. The organic matter, as well as a good deal of the mineral, is held in the meshes of the soil. This takes time to decompose and disintegrate. If the sewage were continuously or too often poured on, the spaces would soon be filled or sludged up; treatment would cease, there would soon be hindrance even to the passage of pure water through it.

Now, on account of the fact that the beds are not used to their fullest capacity, from the necessity of favoring the plants grown, and also from the fact that sufficient land is not always available, and that labor to carry on this ideal method thoroughly would be expensive, the method has been further simplified by leaving out the plant-raising end of it. Thus the sewage is poured over the land, the trenches being dispensed with, all parts acting equally. The intervals between applications can be shortened to the capacity of the bacteria's power of disposing of the sewage. Since plants have not to be looked after, all the time can be given to attendance in distribution and keeping clean the land, and the labor may thus be reduced to the minimum. This method is called filtering, and, on account of the intermittancy with which the sewage is applied, it is spoken of as "intermittent land filtration."

(e) "Intermittent Land Filtration."—In this method raw sewage is poured over all the land, in intermittent doses, with intervals of two or three days between applications. The higher plants have practically no power of digesting raw material for food purposes for themselves, but bacteria can. It is only the finished product which higher plants use. The finished product is not harmful, so can be run off with impunity. The higher plants obstruct the function and growth of bacteria, so that in this method of intermittent filtration the bacteria are placed in the most favorable circumstances when the land is kept free from higher plant growth. Cropping with this form of treatment is looked on as reducing (according to form of plants grown) the disposal powers of the bed from 25 to 40 per cent. The intermittancy is with the object of giving the bacteria between doses a sufficient time to decompose all the organic matter of the last charge. We have already seen that, of the organic matters, all are not equally and rapidly decomposable. A point worth noting in the application of the dose of sewage is to do it as rapidly as possible, consistent with non-erosion and serious disturbance of the surface of the beds. The bacteria which do the work in this process are the aerobic ones. If the application be long drawn out, unless in a very fine rain, it cuts off a free oxygen supply, and, as has been seen before, this means crippling the action of the bacteria, and, if long continued, may even kill them out. This brings us to another point with reference to the application of sewage. It is, not to put so much on that it will take more than, at most, five or six hours to sink into the land. For this to be done with uniformity, all matting or caking of sludge on the surface must be avoided by frequent removal. This is especially necessary if there be much fat or oil or tar in the sludge. These prevent oxygen getting into the soil freely, and if in large quantity may prevent its entrance entirely, as well as preventing the entrance of the fluids of the sewage. The fats will in time decompose, but the tar will not. It is on this account that such substances should be prevented, as much as possible, from getting into filter beds.

The draining of the beds is also important. The products of bacterial action must be carried off if the bacteria are to go on performing their function. With the land water-logged, the bacteria cease their function. Now, different qualities of land, e.g., clay and sand, vary in permeability. This must be kept in view when dosing sewage beds. Is it clayey? This does not drain well. A very much less quantity of fluid will pass through than will go through sandy land. And so for all intermediate qualities, from sand to clay. The better the capacity for drainage, the less bathing in poisons the bacteria will suffer; the more work they will do. Thus sandy soil is always the best. All lands will treat sewage. But all lands will not treat an equal quantity, or with equal completeness. Not all the fluid that goes through a land is necessarily treated. In clayey land cracks and crevices are often found, especially in dry weather, through which totally untreated fluid may pass.

Bacteria can use up only so much organic matter. The rest is untouched. Dilution has very little effect on the amount of organic matter treated. At the Lawrence Experimental Station sewage was diluted twice and three times with water. The treatment was practically the same in all three sewages. In other words, if a certain area of land will treat the organic matter in 10,000 gals. of sewage, then if that sewage be diluted with an equal quantity of water, thus making it 20,000, the result in organic treatment will be practically the same. This is also the case if it be diluted to 30,000 gals. It is the quantity of the organic matter that counts for most, and not the quantity of fluid. Of course, this must be understood to be within certain reasonable limits. If the sand cannot get rid of the water sufficiently quickly, the organic matter will not be treatel at all, or only partially.

At Berlin, Ontario, a process of intermittent land filtration was installed in 1891. As the town grew and the sewage increased in quantity the beds became less and less able to perform their function; they were overworked, water-logged, sludged over the surface, practically all aerobic bacterial action was stopped. These beds became veritable cess-pools. Then, to make things worse, the wastes from tannery after tannery were poured in, also from a brewery, from laundries, and from the gas works. The tanneries increased the organic matter to be treated, added materials like tannins, that are treatable at best only in the smallest quantities under the most favorable circumstances; also sent down fats, as the laundries do from their soaps; and, besides this, a quantity of finely divided bark fibre, which is almost practically non-disposable, being almost non-putrescible. The brewery sends down the husks of grain, and the gas works sends down a tarry oil, which is probably the worst crippler of a disposal bed possible Altogether, Berlin's 14-acre clay intermittent filtration farm was treated as roughly as was possible. To make things worse still, the surfaces of the beds were not kept clean. One man's labor could not possibly keep the surfaces, under the circumstances, even in fair condition.

To show how hard an old idea dies, with all these circumstances against them—too much sewage, bad filtering material, ill-putrescible substances, objectionable sludging material in the sewage, insufficient labor to keep the surface of the beds free from sludge—an attempt was made, and is being continued, to raise crops on these beds. They raise good crops, but reduce the disposing powers of the beds in a notable degree, when they are already trying to carry a burden twenty times or more than their capacity.

To the State of Massachusetts is due the credit of bringing the intermittent land filtration of sewage to its highest development. They have abandoned all other forms of land but sand for the working of this system, so that the process has come to be called "Intermittent Sand Filtration." A considerable quantity of good, well-drained sand can be found almost anywhere in the State. The system has been generally adopted throughout the State, and during the last fifteen years has done all that was expected of it. It has been perfected in detail, and worked out in theory, until now, of all the methods of treatment of sewage, it is the best, giving effluents not much worse than a good drinking water. In fact, many drink waters are of a much inferior quality. All that is required is a sandy soil of pure sand of four or five feet of uniform thickness. The top earth is thrown up to make banks between one-acre lots. It is drained with ordinary farm tile, four inches in diameter, laid in lines forty feet apart across the bed and leading into a common effluent carrier. A central wooden or cement affluent conveyor is run across the top of the whole bed.

The construction is simple, and comparatively inexpensive. At Brockton, Mass, their farm has been in existence over fifteen years. It has not deteriorated; in fact, it is doing better work to-day than at the beginning. It is treating, the whole year round, an average of 35,500 gals. per acre per day, counting in times of rest, repairs of drains and intermissions. The application to the surface is often 200,000 to 250,000 gals. at one time. They have 25 one-acre beds (19 only are in commission at present), for a population of 30,000 people, all using the sewers. These are used alternately, beginning with No. 1, going on to No. 19, and coming back to No. 1. Each bed thus gets several days' rest between each dose. More could be treated if necessary. But, so far, it has been preferred to buy new beds than to run any risk of sludging up those they have, that are doing such good work.

Essentially raw sewage is being pumped on to these beds. It is collected in a circular reservior, capable of holding all the twenty-four hours' sewage. Three to four hours' pumping each day is all that is required to empty this. The towns I visited, during my Eastern trip, using this form of sewage disposal were Brockton, Clinton, Andover, and Hopedale, all of Mass. All of them are doing good work, and producing effluents practically beyond reproach. There is practically no odor about them. If one did not know there was a sewage farm in the district, he would never suspect its presence. Several very nice houses have been built within a couple of hundred yards of the Brockton one, and many new ones are being put up.

The cost of running these beds, outside the pumping, is not high. A couple of men are employed to keep down the weeds and to turn on the sewage. The surface of the beds are scraped over not oftener than once in three months, and it is only half an inch or so of material that needs removal. The neighboring farmers usually carry it away for manure, though its value is not very great. During the winter time the beds work as well as in summer. The only change in treatment is to ridge over the whole surface as some farmers ridge up the land in the country to cultivate turnips, beets, etc. This is usually done by a plough going up one side and down by the other, and then smoothed up with a hoe.

When, in cold weather, the sewage is run on to the beds, filling them to the top of the ridge, it freezes on the surface, leaving plenty of space between the ridges and beneath the ice for all the sewage applied. The salts in sewage keep it from freezing solidly, and, besides, chemical action going on in the sewage keeps up a certain amount of heat. At any rate, it does not freeze under this sheet of ice. The surface if anything, is increased for filtration. Sludge does gather to some extent, but falls to the bottom of the trenches. This is scraped up in cakes in the spring and carted away, and the ridges harrowed down level again. Sometimes the surface is ploughed over and harrowed. This improves the treating power of the beds. A study of the following figures for these Eastern towns will show what "intermittent sand filtration" will do with sewage:

City.	Average gallons per acre treated.	Free ammon.	Alb. ammon.	Oxygen cons.	Chlorine.
Brockton, Mass.	35,500				
Raw sewage		3.01	1.36	6.44	6.59
Effluent		.1766	0123	.13	
Framingham, Mass	27,500				
Raw sewage		3.1012	3.145	29.46	8.45
Effluent		.6382	.0176	.18	
Lawrence, Mass. (experimental filter)	90,000				
Raw sewage		3.080	0.590	4.01	6.60
Effluent		.1113	.0207	.27	

Better than this could hardly be asked. All it requires is plenty of sandy land. During our experiments at Berlin, Ont., we went over the hills to the east and west of the sewage farm, and dug a large number of test-holes. The land to the west, all along the ridge shows good gravel for a considerable depth, and not more than, on an average, of 15 to 18 inches below the surface. By terracing, from eighteen to twenty acres of beds could easily be made. There is one slight objection in some parts on this side. It is that about eighteen or twenty inches into the sand is a one-half inch clay stratum, which might interfere somewhat with filtration. To the east from the farm is land of a much better quality. On the very surafce, the sand looks like drift sand, but after a couple of inches it is just of the quality required, and twenty-five acres could easily be made up, and at very little expense, beyond scraping off the top soil, which is here much thinner than on the west side. The greatest objection to this side is that it is closer to the town. Both sand lands are about on an equal level, some twenty feet above the sewer level at the farm. The sewage would require to be be pumped to be applied to these beds, if constructed. All the Eastern cities pump, and consider themselves fortunate to have the good sand-beds at such small cost. There are no sand-beds along the valley on the same level as the sewage, or below it, within at least three miles below the farm.

With the sewage of Berlin at its present composition and quantity, nothing less than three or four hundred acres of the present clayey land would do to dispose of its sewage.

The average composition of Berlin's sewage is: Free ammonia, 2.542; albuminoid ammonia, 2.017; oxygen consumed, 49.95 per 100,000 parts.

In free ammonia Berlin's sewage is weaker than that of Brockton, Mass. Its albuminoid ammonia is one and one-half times as strong, and its other organic matter possessing the power of decomposing permanganate of potash eight times as strong. This last is not so important as the albuminoid material, though not to be neglected. It could, in large part be got rid of by other methods to be mentioned presently.

Now, since Berlin's sewage, in its most objectionable feature, the albuminoid ammonia, is one and a-half times as strong as that of Brockton, Mass., and since Brockton, requires one acre for each 35,000 gals., Berlin would require one and a-half acres for the same amount, and since Berlin has, on an average, 450,000 gals. a day to treat, it would take about nineteen acres of sandy land of the same character as at Brockton if raw sewage was to be treated; but auxiliary methods to be mentioned later can be introduced, which will make Berlin's sewage weaker even than Brockton's, and, in proportion, will require less land for this final process of "intermittent sand filtration."

Now, though "intermittent sand filtration" can treat raw sewage in such large quantities per acre, and is admitted to produce the best effluent of any system of sewage disposal in vogue, in certain localities it is difficult or impossible to carry out this method. The land may be too expensive, or there is no sand. It might be carried, but this by the acre at four feet depth is expensive. Sanitarians have been on the lookout for some process that would act as auxiliary to this method, or even replace it.

(f) The Septic Tank.—It had been observed that from old cess-pools water ran away almost clean-looking, and, curiously, when an attempt was made to clean them out very little or nothing was found. Why was this? The effluent was not like raw sewage, and did not answer chemically to it, and there was practically nothing accumulating in the cess-pool. Bacteriology solved the question. It was found that the conditions favored the growth of a certain class of bacteria, and that these bacteria produced such substances (enzymes) that in their action introduced a molecule or molecules of water into organic substances, which union resulted in the disruption or breaking up of the molecules into simpler ones. Sometimes all was converted into gas, as, for instance, to state a couple of reactions a second time.

(Albumen), $4C_8H_{13}N_2O_3+14H_2O=4N_2+19CH_4+13CO_3+2H_2$;
Or (Urea), $CO(NH_2)_2+H_2O=CO_2+2NH_3$.
or again, (Sugar), $3C_2H_{12}O_6=2CO_2+{}^{12}H_2O+2C_2H_6O$ (alcohol).

Part of the substance was converted into gas, the rest of it, presents in a simpler form.

The alcohol or the simpler compound will be converted later on in the effluent of the tank by a process of oxidation, and be finally gasified, thus disposing completely of the sugar. These compounds can be destroyed in the cesspool, but more slowly than the original ones. Now all organic matter is more or less completely disposable by this method and of course when the process is complete there is nothing to remove. All that would accumulate in such tanks would be insoluble mineral matter, and such organic substances as are with great difficulty decomposable. Now the bacteria that do this work are found to be the anaerobes, and the reason that they grew so well here was that the oxygen coming in with the sewage (there is not more than 7 c.c. of it in one litre of sewage) is all taken up by the chemical changes going on in the sewage. In the cesspool from its size there is practically no agitation going on, so that exposure of the deep portions to the surface rarely if at all take place. A freedom from oxygen exists after the first inch or so in depth is reached. An anaerobic condition is produced, aerobic bacteria cannot functionate there, and may even be killed out. Now a tank where this condition is produced is called a septic tank, or one in which rotting or decomposition or putrefaction of the organic matter of sewage can be carried on, and would of itself be able to treat sewage completely if time were given. Under working conditions this would be found impracticable. After the first almost sudden disruption of the complex proteid, carbohydrolactic and fatty molecules of the sewage and liberation of gas by hydrolysis, the simpler remaining compounds are with more difficulty acted on; at least a considerable time is required. Aerobic bacterial action such as takes place in "land filtration beds" does this much more rapidly and completely ,so that it is found much better and much more economical to divide the work between the two forms. This tardiness in the decomposition of the simpler forms of matter found after this first disruption may be accounted for in this way. We practically have bacteria for the destruction of each of the compounds, the ground is taken up by the first hydrolytic set and it is found in bacteriology that when one form gets the start it is difficult for another to step in or live with it. If they do they modify the action and function of one another. Is it that in the case of the simpler compounds the proper bacteria for their decomposition are not present, or if present are handi capped by the first set, and not being able to perform what they might do rapidly if given a chance now do it tardily? One of the problems we look forward to working out in the laboratory is—Would the effluent from tank A run into tank B by a process of selection encourage the growth of such organisms as would attack these simpler compounds and thus get more work from the septic tank system?

The septic tank has come to be one of the greatest auxiliaries to the treatment of the organic matters of sewage. The sewage is retained only long enough to get this first hydrolytic action. By it the matter is either completely broken up into gaseous substances or into simpler compounds. What has taken place in a gross fashion is that by gas formation bits of tissue, masses of faeces, pieces of paper, etc., are exploded as it were, broken into smaller particles, and liquefied, the remaining heavier portions settle down to the bottom of the tank and are further acted on—exploded—: finally what falls and rests for good at the bottom are only such substances as are no longer capable of being decomposed. This is called "sludge." Now this settling holds this practically non-putrescible material back, preventing it thus getting into the filter-beds. This is the material that "sludges up" beds. The organic matter leaves the tank minus its gas and appears in simpler forms to be treated when run on the proper beds by the aerobic bacteria almost exclusively there, by a process of selection on account of surrounding circumstances, as has taken place previously in the septic tank with reference to anaerobes.

The gases that come off from septic tanks, as the substances which enter, are various. The chief are CO_2 H. N. CH_4 CO, sometimes H_2 S (NH_4) 2H. There are various aromatic substances besides these given off. Some septic tanks give off very offensive odors, others none at all. In the present state of our knowledge no one can prognosticate whether a certain tank will be foul-smelling or not. Perhaps it is due to the special forms of bacteria that have come out of the process of selection, that has taken place when the tank was started.

It has been found in practice that open tanks do as well as closed ones so far as treatment is concerned, as so little oxygen is taken in from the surface and all deep down is used up. If a tank gives off offensive odors it might be better to close it and ventilate with a high shaft or chimney. At Clinton, Mass., during working hours the gases were directed into the fireboxes of the pumping plant. The engineer thought it made some difference in the coal consumption. The gas was from 750,000 gallons. On an average one gallon of mixed gas is given off from every 100 gallons of septic tank sewage. At Exeter, in England, the gas has been used for some of the lighting of the works. A scum from 1-1-6 of an inch to eight or 10 inches in thickness collects on the surface of most septic tanks. This is made up of bacteria and sewage particles rendered buoyant by gas bubbles. It was at one time looked on as a necessary thing in a well-working septic tank. It is looked on now as only an incident. Tanks without it show as good treatment as those with it, and frequently during active function the scum disappears completely to perhaps again reappear and disappear.

Thousands of larger or smaller bubbles may be seen rising to the surface of an active tank. In the winter not so many rise as in summer. The tanks do not do so well either, though not always are tanks acting according to the bubbles they give off. These gas bubbles are not peculiar to septic tanks. We see them in all waters where bacterial action is going on. A sediment or sludge collects at the bottom of septic tanks when in use for some time. It is a thick granular, blackish substance, and looks like a thin black mud. It is made up of sand, clay, wood-fibre, cellulose and an almost non-putrescible organic substance remains. When carted on to land and allowed to dry it is grayish in color and looks like macerated paper. Examination of this at the Lawrence Experimental Station has shown the organic matter to be chiefly unaltered cellulose and wood fibre and almost useless as a fertilizer, unlike the sludge from chemical precipitation, which has weight for weight, according to Prof. Shuttleworth's analysis, an equal value with ordinary barnyard manure. Autumn sludge contains less organic matter than spring sludge. Three of the septic tanks at Berlin were divided into four equal parts. The first compartment was really a grit chamber. From May 27th to September 25 the tanks running continuously, nearly the whole of the first and 1-3 of the second compartment filled with sludge. In the other two compartments not more than an inch had collected at the bottom, a very small quantity when it is remembered that about 1-25 of a column of the raw sewage on standing was sediment. The composition of the sewage has considerable to do with the treating power of a septic tank. At Worcester, Mass., the sewage contains a considerable amount of acid iron in solution. Twenty-six per cent. of the organic matter is removed or treated in spite of this. At Exeter 17 1-2 per cent. and at Leeds 59 per cent. was removed by the septic tank. At Berlin our average was from 44-55 per cent. in the different tanks. Of course these last were summer results, with a temperature of 60 to 65 degrees F. during their active period of a slowly putrescible material. In the winter time the average temperature at Lawrence Station during 1900 from Nov. to April inclusive was 46.3° F. of effluent. The average treatment was 58.9 per cent. With a summer temperature of 65.8° the average treatment was 56.3 per cent. In this particular case the treatment is in favor of the winter months. However, this is not always the case. When starting a new tank it takes some time before any change beyond a mere mechanical one is observed. Experience in Berlin confirms this. We started two up-town tanks on May 27th, and as late as June 25th there was no treatment. Warm weather commenced, the analyses on June 30 showed a removal of 40 per cent. in one and 60 per cent. in the other. From June 28th to June 30th bubbles for the first time began to appear, and bubbling was rather vigorous. The two tanks at the farm were started on June 25th, on the 26th no treatment was observed in either of them. On July 7th the large one showed 41.5 per cent. removal, whilst the smaller one showed 40 per cent. The large tank had only been cleaned out before beginning it. The smaller one was new and yet showed only a slight difference at this time in treatment.

It has been recommended to seed a new tank, as in the vinegar process it is started by placing some mother of vinegar in the apparatus, with scum taken from a working tank. A considerable quantity of sludge had been left in the big tank at the farm and yet it did not show any great advantage over the new tank, into which only raw sewage went. The two up-town tanks did not show any treatment for one whole mouth, and then woke up in two days to a very large treating capacity. All of these tanks were started running with double their capacity in the 24 hours, a rather heavy dosing, e.g., each of the uptown tanks holding 600 gallons, 1,200 gallons were run through in the 24 hours.

Our Berlin experience has shown about a 10 per cent. difference between the treatment in a double capacity and a single one, in favor of the one capacity.

A septic tank serves several purposes. It is most important of course in the decomposition of the organic matter; the retaining of suspended matter, sand, paper, faeces, and even more finely divided material, is another important purpose. This saves the beds. Another and not to be overlooked function is to hold floating matter, especially fats and oils. These substances are capable of doing great damage to beds. They are treatable, but require much more time than ordinary organic matter. Now in the construction of the tank these three functions, especially, must be kept in view. To meet the first, viz., the treatment, sufficient capacity must be given. Enough space to get the fullest benefit consistent with economy should hold the whole of the sewage of the 24 hours. There is no objection to depth consistent with cleaning when this is required. Ten feet, unless there be difficulty in excavating, would be a good practical depth. It would be well to have the tank not more than three times as long as broad, so that the sewage will pass over a broad space and thus minimize currents and stirring up as much as possible, for it will be found preferable to run the sewage through continuously. If it is taken out by any mechanism that suddenly removes a considerable quantity, too much stirring results in considerable suspended matter being carried out that should be left behind. Now arrangement should be made that the inlet be large, so that the entrance be slowed, and made considerably below the surface, so that upward pressure will aid in the precipitation of suspended matter. The outlet should also be broad and below the surface, so as not to carry off any floating scum. This would not be good for the beds. To arrest the coarser substances the first compartment should be a grit chamber with a partition running up to the sewage level. Over this partition, the entering sewage, after rising overflows. To hold the lighter sludge the fermentation chamber proper should have baffle boards at two places to within half way up to the sewage level. To facilitate cleaning, gates should be put in those baffles at the bottom, so that when it is required these may be opened, so that the sludge will flow towards the grit chamber, which end of the tank should be on a gradually lower level for this purpose.

To retain the scum and floating fats and oils baffle boards should be let down from the top of the tank to at least a foot or eighteen inches below the level of the sewage.

The material out of which the tank is made is of little consequence, so long as it is a non-putrescible or non-rotting material. Wood is soon crumbled away.

No chemicals are needed, not much labor, only space. It is about the heapest way possible of getting rid of half of the sewage. It saves the beds by holding back suspended matter, and gives to the beds materials already prepared for further bacterial treatment, thus saving at least fifty, actually nearly 60 per cent. of filtering space.

The septic tank system is not a complete method of treating sewage. In practice it is the greatest auxiliary to its treatment. It treats half and prepares the non-finished material, or puts it in a condition chemically and physically in which it can more easily and in a greater quantity be treated by any given filter bed area.

At Lawrence Station they have suspected that over-septic treatment is harmful to the aerobic treatment to follow. Perhaps this is due to the fact that too much toxic substance is sent over into the beds. They were prompted to this conclusion by the indifferent treatment that septic sewage experienced when going on the intermittent sand filtration beds at Andover. The sewage here travels a long distance from the town and remains for a considerable length of time in a large inverted syphon crossing a large valley before reaching the septic tank, and this retained in the tank probably had too much septic treatment. This question is being investigated carefully by them; in the meantime we anxiously look to the results of their experiments.

(g) Chemical Treatment of Sewage. The ideal end would be to gasify, and reduce to its original elements the organic matters of the sewage. There are chemical methods of doing this, but not such as could be used on a large scale or could be used within anything like reasonable cost limits either. The process in use is to coagulate and precipitate all that is possible. It was thought at one time that all could be so precipitated in practice; but this has been found not to be the case. In London, England, the sewage removal is only 30 per cent., in Worcester, Mass., 50 per cent., and this last is about the best possible by this method. The chemicals used, though cheap, when used in the proper proportion, come to be a large bill of expense. Lime is one of these chemicals. Ten grains are frequently used to each gallon of sewage, and is a small quantity to use in many cases, would amount to 6 1-2 tons of lime per day where one million gallons of sewage a day are treated. Other chemicals are required with certain sewages, and are not, though used in such large quantities as lime is; still they are vastly more expensive (e.g., sulphate of iron and alumnia). The idea in these methods is to coagulate the organic matter in solution; this makes it heavy enough to fall to the bottom. In the process of coagulation a certain quantity of suspended matter is enmeshed and carrid down with the coagulum. After treatment the sewage is conducted to large sedimentation reservoirs and kept as quiet as possible to allow of settling. This cannot be allowed to go too far either, for some of the sediment may again redissolve. The supernatant fluid is run off, leaving a thick, muddy substance at the bottom (sludge); this last is pumped off, mixed with more lime or some other thickening material, and carried to presses to get out part at least of the excess of water. Sludge as it comes from the settling basins contains on an average 90 to 93 per cent. of water. After hydraulic pressing into cakes it will still hold from 70 to 75 per cent. of water. This cake sludge is a bulky material, and has to be carted away. Weight for weight it has about the same value as ordinary barnyard manure. When iron or alum is present in it, there is a question whether or not it be as valuable as the ordinary manure. When it dries, on account of its cake form, it is very awkward to handle. Farmers cannot be induced to buy it, nor even cart it away if given to them. It could be kept until dry, but this encumbers on account of its bulk. It could then be powdered. This would increase its cost. At Worcester, Mass., they are carting it by a trolley line to a near-by valley and filling in with it. The odor about it is not very savory. There is still much water in it along with chemicals. It is in this condition not easily incinerated. The process would be expensive.

The chemicals used are lime and sulphate of iron and alum. The sewages to be treated vary in composition and especially in reaction. Ordinary domestic sewage is alkaline. Lime here is a precipitant. Many manufacturing wastes, e.g., tannery and iron works wastes, are acid. These need to be neutralized. This takes up a quantity of lime to reach the neutral point; after this the farther action is to coagulate. As much would be needed for this last as for domestic sewage, there would be added to this then the quantity required to neutralize, coming very high in some cases. The other two chemicals are used with the idea of bringing down what the lime cannot of the proteid substances and certain of the coloring matters, as the tannins, etc., in tannery wastes for instance. In sewages containing acid iron, the addition of the sulphate metals is not necessary, the iron of the sewage takes their place.

The settling basins require to be large, so that unnecessary currents are avoided, whilst the treated sewage is passing through, to allow of the needed amount of precipitation. They are not usually covered, as generally there is no objectionable odor coming off. The treatment is only a partial one. At best half of the organic matter remains, the bacteria natural to it are more or less destroyed. This untreated material when carried into a water course goes much farther than if it had its destroyers with it. It has eventually to be treated. This fact, though, has some benefit. In Hamilton, Ont., before the chemical method was adopted the bay was becoming choked up with water plants. Now even near the end of the season, though there be some present, the bay is comparatively clear of them, even up to the shores. The half-treated sewage probably is carried far out before the new set of bacteria have increased sufficiently to make the material good food for water plants. In the case of a river this would be harmful. As it is now the sewage from a town is more or less removed by the various methods already outlined before, the next town is reached. In the case of those chemically-treated sewage the material might reach the next town before it began to be treated and give rise to danger, especially when the rivers are depended on for water supplies. We might as well face the fact first as last. To get rid of organic matter bacteria must be called into action sooner or later.

The method is used as a preliminary one to land filtration and is a useful one, though not as good as the septic tank method. There is more danger from objectionable material getting into the beds. The chemicals used when in excess, or even in their combined stage are harmful to bacterial growth, and so much depends on unobstructed bacterial growth in land filtration. However, land filtration gives very fair results after it. The beds can be reduced in number beyond what would be required for raw sewage. And in the case of manufacturing wastes objectionable chemical substances can be prevented by their precipitation from raching the filter beds.

Compared with the septic method, much more plant is needed. In the chemical a mixing place is required for the raw sewage, another is required for the sludge, a sludge pump is required and then a sludge press, and this has to be running almost continuously. The haulage is much more serious also. In the septic method the sludge is removed from each tank perhaps not oftener than once in 3 or 4 months. The pump is then only a simple one. As for reservoirs or basins, for the septic very little more space is required than for the chemical. The objections to the chemical method are:

(1) The chemical method costs much more than the septic ; (2) it does not on the average remove as much organic matter; (3) what it does remove is only temporarily so; (4) there is the great difficulty of removing the sludge ; (5) when the effluent is passed to "land filtration beds" it is much more likely to sludge them up, and besides the treatment is not so good. The material has not been seeded, as it were.

The good point of the method is that it can be used as an aid to the septic, by being put into operation at factories to hold back objectionable material that might get ino the disposal plant. As, for instance, in the case of a tannery, a great quantity of the hair, bits of hide and precipitable matters, tannins, etc., could be withheld, so large as 50 per cent. The process, after all, should not be thought of as chemical only. It is only partially so. The greater part of the process is mere mechanical sedimentation. It is in the last phase especially that it is useful in the treatment of factory wastes.

(h) Contact Beds. Though it has been shown that intermittent sand filtration beyond any doubt is the means at our disposal which produces the best of all effluents with sewage, there are circumstances where it is next to impossible to install such a system. Intermittent sand filtration requires a considerable area of good sand for its purpose. This is not always procurable in the neighborhood of towns. Then it may be said they can be built. Four feet deep of sand in acre beds would cost a considerable sum if this had to be carted. Then again under some circumstances though there be sand, the land is not procurable. There are other circumstances. Perhaps it would be necessary to pump the sewage to the land. Under some conditions this would be very expensive, not meaning by this that pumping is always expensive.

Sanitary engineers have expended a good deal of time and ingenuity to find a substitute for intermittent land filtration. The "contact bed" is the best compromise that has so far been devised. No contact bed gives the effluent that intermittent sand filtration gives, but it is better where his form cannot be used to get the next best, and the contact bed method gives this. A contact bed is a sewage treatment bed in which the material used is placed in such a manner and is of such a character that free oxygen will gain easy and continuous access to every part of it, thus allowing the aerobic bacteria on which dependence is wholly made for the treatment of sewage to perform their function at their best. Into this the sewage is run to overflowing, with as little delay as possible consistent with non-disturbance of the material, and allowed to stand in contact with the bed's material (sometimes called filtering material, though it is not except for the very coarsest suspended substances) for a stated time. During this time the enzymes or ferments, that the bacteria have formed during their period of rest preceding this running on of the sewage, attack the organic matters and bring on oxidation, that is introduce oxygen into the compounds, resulting in rearrangement of the molecules of which they are composed, into simpler and simpler compounds until finally only the mineral portions remain. This is precisely what is done in the intermittent sand filtration beds, only in the contact bed there is a greater supply of oxygen, more active change takes place and much more sewage can be handled. After standing this stated time, usually not more than two hours, it is gently run off so as not to disturb the bacteria that are attached to the materials of the beds in the shape of a gelatious scummy substance, a zooglea mass as it were. If the sewage be left longer than three hours all told in contact with the bacteria these organisms are likely to be injured and may be even killed out. It is often found after a too long contact that it takes the beds sometimes even weeks again to recover their treating capacity. A contact bed is a very delicate living machine, which requires gentle, careful and skilfull handling. A man may go down in a diving-bell and perform so much work. When his air supply runs out he must be brought back to the surface, if left down he dies. The aerobic bacteria during contact with sewage are in the same position, when their oxygen supply runs out they must get more. If left too long without they too die. When the bed is emptied, the surface of course becomes clear of sewage first, then farther and farther down, until the bottom is reached. This running away of the fluid produces a void, into which the air from the surface is sucked, thus supplying it to the very bottom. And it should go there in a good contact bed. Now the bed is allowed to rest for from two to three or even four hours before the next dose is applied. Three doses to a bed in 24 hours is hard work for it. During the period of rest the bacteria live on the organic matter that is left in contact with the filter-bed material, building up more and more ferments, until at the end of the period considerable has accumulated. Now when the next dose is applied it is immediately attacked and oxidized as in the first instance.

Now though this form of bed treats a large quantity of organic material, it does not unfortunately decompose all that is run in. This is probably because a not sufficient quantity of oxygen can be got at. This is shown by the fact that after a certain period in the contact is reached no further treatment goes on. This period has been found in most cases to be reached in three hours of contact. There is nothing to gain in leaving it longer and all to lose in that our bacteria may be smothered out. Another explanation too is that possibly the products of bacterial action inhibit the function of the bacteria and even kill them. At any rate, the beds must have periods of rest. It has been attempted by mechanical means to supply a greater quantity of oxygen to contact beds to see if better results could be got. Perforated pipes have been placed horizontally at different levels in the beds and into these air is forced, in some cases previously warmed. A good deal of disturbance in the bed takes place, which probably does more harm than good in that it disturbs the bacterial scums on the bed material. At any rate it has not given what was expected. The treatment is no better, even worse in some cases, and such beds especially are found to sludge up much more rapidly than those without this artificial air supply.

The question naturally comes how is it that these beds do not fill up or sludge up with the suspended matter going into them in such quantities. These solids are not all decomposed in this short time. And the beds do in fact sludge up, and this is one of the serious objections to them. When a bed is started, if record of its interspace capacity be taken note of, it will be seen that for the next six weeks or two months it gradually becomes less. After this period is reached they frequently run for even years without showing any serious or appreciable diminution in capacity. The action going on is more complete than that going on in the septic tank; not so much sludge is left behind. They will nevertheless finally become filled up to such an extent that they will no longer work at all. Sometimes if a period of five or six weeks rest be given the bed it may recover in great part its former capacity. It has accumulated probably a material that is very slowly putrescible. During the period of rest this becomes decomposed, and the space restored. Wood fibre and cellulose would act in this way. But if the sludging be due to mineral matter then it does not recover. The material has to be renewed or taken out and washed. This sludging up takes place much more rapidly when raw sewage is used in the bed than when the material has had some preliminary preparation such as screening, sedimentation simply, septic tank treatment, chemical coagulation or sedimentation. All these processes besides reduce the quantity of organic matter entering into the bed for treatment. The septic tank does this to the greatest extent of all. This last too is of more value still in that it primes the organic material, so that it is more easily attacked. And of course this means that the contact-bed area can be reduced. There is not so much work to do.

These beds are not filter-beds. They are simply beds in which the sewage comes in contact, under very favorable circumstances, with the active bacteria. These beds may be made of various materials. Coarse or fine gravel, screened so as to remove the sand, is used.

The efficiency of a bed is calculated on its finest material. It it be sand, then the coarse material is of no use. Sand is not a good material for contact-beds. It is too fine and leaves too small interspaces for active oxidation. At Berlin, we found the best treatment to be in the bed that had the finest gravel—one-eighth inch—next the one-fourth inch, and next the half-inch. The greatest interspace capacity was in the coarser bed, of course, and, therefore, the greatest amount of sewage for treatment was in this bed. The probable reason for the best treatment in the finest gravel bed was the fact that this bed held less sewage.

Fine broken stone, such as is used in some cities to increase friction for horses on slippery pavements, the screenings really from stone-crushers, freed from the fine material and coarser stone, such as is used for macadamizing roads, have been used. This occupies considerable space in itself, and leaves large interspaces, and does not, in consequence, supply sufficient surface. Still it has its advantages in that it is practically indestructible.

Fine broken brick is used, as also burnt ballast, and both are of about equal value. Soft coal clinkers form a good material, but are apt to crush after a time. Clinkers from all coal is not alike in hardness. Some crush easily, others are quite hard. Then comes coke. This is an ideal substance in that it is porous and is rough, and this presents more treating surface. It has another good point, viz., that when the bed is sludged up it may be taken out and burned, having lost practically none of its burning quantity or quality. Some very good hard coke is procurable from the coke ovens near Pittsburg, Penn. Some of the cokes are easily crushed, and this is a serious defect in a contact-bed, leading to bad aeration and filling up of the bed capacity by sinking, etc.

Charcoal, though a good material in many ways, is so easily crushed that it is only under very exceptional circumstances advisable to use it, e.g., in small plants, where it can be taken good care of.

Coal has been recommended, also. It does not possess any special virtue, though, over many other materials, as crushed stone, for instance.

The material out of which a contact-bed is made makes very little difference in the treatment. It should be rough, but porous, not in too large pieces (half-inch in diameter at most), and of a good durable material that will not crush. It would be well to be like coke, a good material to burn when no longer useful as a treatment medium. The thing is to use what is cheapest and best at hand, consistent with efficiency.

Regarding the construction of these beds, it may be said that if the land on which the beds are to be constructed be a porous one, the beds have to be walled, and have a bottom made that will be next to water-tight at least. If the sewage can filter through the bottom, contact cannot be maintained. Some beds I saw last summer took between five and seven hours to fill. The inlets were large enough to fill them in an hour. No true contact treatment was possible here. If the land be clay, then all that is necessary is to excavate to the necessary depth, from two to four feet; a greater depth presents too great interference with proper aeration and no advantage. The bottom should be well drained with ordinary tile drains, placed in contact only, with no cement. It is well to bank the drains with coarse (three-quarter inch will do) screened gravel, free from sand. The gate controlling the outlet from these drains should be of such a kind that the flow may be checked, so that it take nearly as long to empty as it took to fill the bed, so as not to disturb the bacterial scum and attached sludge of the bed material. We must think of the head under which this emptying takes place. There is considerable pressure under four feet of fluid. Where there is much fine suspended matter in the affluent, a couple of inches of sharp sand is a good device to retain it and prevent it getting into the material proper of the bed. This sand can be removed from time to time, every month or six weeks, and more be applied. It becomes thus an additional expense, but where manufacturing sewage is being treated repays the outlay richly. It holds back fats and fine suspended material. It is to be raked over every few days, otherwise it soon sludges up.

The inlet pipe to the bed must be large enough to fill the bed in at least one hour's time. A trough distributor should be placed over the surface of the bed, so as to feed the bed evenly in all parts and at the same time, seeing at the same time again that there is not such a rush on to the surface that the bed material be disturbed or disarranged. Very few automatic arrangements for regular distribution of sewage to beds are reliable. Intelligent attendants are far more profitable, even though they cost more. The beds should be made of such a size, calculating on one hour to fill each, that there will be no hours between that sewage will have to be run off without contact, taking into consideration the "cycle time' for each bed. The cycle for a well-run bed would be one hour to fill, two hours of undisturbed contact, one hour to empty, and from three to four hours' rest before the next dose is given, making the cycle time from seven to eight hours. Eight beds should then be constructed. Three applications in every twenty-four hours would be about as much as any bed could stand and do efficient work.

The effluents from contact-beds frequently have considerable suspended material in them. To prevent this getting into streams, it is well, under circumstances, to allow this to settle in a sedimentation reservoir of some sort, from which the effluent will overflow. This would not disturb the levels. The reservoir could be made of any depth, consistent with the easy removal of the sludge.

Contact-beds will not commence to treat sewage, except as a coarse screen, the first day sewage is run on a new bed. It takes days, sometimes even weeks, before they commence to treat, and, for the very same reasons as it takes for septic tanks to begin, viz., the selection of the bacteria, and these come from the sewage entering. Raw sewage supplies these more quickly than septic sewage does. For seeding, it is well to make the contacts for the first week or so short. The selection takes place more quickly in warm than in cool weather. Seeding with surface garden mold is said to quicken the process. The advantage of this is doubtful, when the price of it is a partial sludging of the beds, and again it is just possible that the bacteria of this earth are not inured to this special form of food material that is found in sewage.

The effluent from the ordinary contact-bed, not being up to what was required, attempts have been made to improve it by making a second contact on another similar bed, and even at some places, a third bed has been added to get a third contact. Of course, these have to be on different levels, one below the other. The effluent from bed one passes on to the surface of bed two, that from bed two on to the surface of bed three. It has been proposed to add even a fourth.

These could easily be regulated in such a way that a weak sewage would be contacted in one, a stronger one in two, and so on to even the fourth. In this way, by intelligent handling, a large treatment might be got.

The results obtained at Sutton, in England, showed that on an average 770,000 gals. of crude sewage could be treated each twenty-four hours, showing an average purification, as to albuminoid ammonia and oxygen consumed of 64 per cent. At Manchester, England, using a preliminary septic tank treatment, 700,000 gals. of sewage per acre per day, it was found that, on an average, a purification of 75.2 per cent. of the albuminoid materials and 90.1 per cent. of the oxygen-consuming substances could be got, but this was after a double contact.

At Lawrence, Mass., in 1899, on an average, 700,000 gals. per acre per day of stale sewage was treated, with a percentage purification of 61 of the albuminoid material and 55 per cent. of the oxygen-consuming substance by the first contact, and 79 per cent. of the total albuminoid material and 75 per cent. of the oxygen-consuming substances by the second contact.

At Berlin, Ont., during the last summer's work, we were able to get on an average, 70.6 per cent. purification of the albuminoid material and 67.1 per cent. of the oxygen-consuming substances, by one contact, after using a preliminary septic treatment, running at the rate of 565,000 gals. per acre per day, leaving an effluent still containing of albuminoid ammonia .596 parts and of oxygen-consuming substances 16.43 parts per 100,000, an effluent that was still putrescible.

It is hardly possible to get a complete treatment from a contact-bed. The effluent is not aesthetic, by any means. To come up to the standard of treatment required, it would need to be well diluted when passing into the final water-course. It is a compromise method. The result can hardly be compared with the effluent of an intermittent sand filter. Certainly a greater amount of sewage is handled to a given acreage, and in a given time, and certainly more organic matter is disposed of, but much more is passed through untreated also, and this is inseparable from the method. It is impossible to hold it longer in the bed for treatment, the bacteria would be killed out. The bed has to be filled at each sitting. Three or four doses can be given a day as well as one, and one would not treat any better than if three or four were given. The bed deteriorates much more quickly than the intermittent sand filtration one, and has to be renewed. It has to be handled with a great deal of skill and discrimination. It must not be left with the sewage in contact over time. It must not be drained away too quickly, nor filled too quickly. If it commences to lose its interspace capacity, this must be immediately recognized, and rest given it, or it may irretrievably be spoiled and sludged. Another disadvantage is that night men have to be used to keep the beds going. This, of course, could be got over by having a reservoir to hold all the night's sewage, treating it on the beds the next day. This would need fall, though, or pumping.

Its great application is where a not perfectly purified effluent is needed, as, for instance, where the effluent is going to be discharged into the sea or into some large water-course where a sufficient dilution can be had, and where the next town below is a long way off, i.e., far enough to give Nature time to decompose the rest.

Again, it has an advantage where sand cannot easily be got, and artificial beds have to be made. About five or six times less area is required to treat a given quantity of sewage than where sand is used for intermittent filtration. It will treat septic sewage better even than crude sewage, as the septic system has the same use with reference to these beds as to sand beds, doing half the work, only half the quantity of bed is required.

It is a compromise, too, where it would be necessary to pump a sewage to reach sand-beds, where all the handling by a contact system with a very few feet of fall could be done by gravity.

(i) Continuous Filtration. This is another compromise method. It is based on Moncrieff's experiments, which consisted in placing more or less fine coke, or some such material, on shallow trays, seven inches deep, and placing these trays one above the other, with three inches of space between them, to allow of free aeration. The sewage is allowed to pass on to the upper tray, intermittent triangular tipping boxes being used, then through perforations in the tray on to the second, and so on to the third, fourth, and so on even to the last. The organic matter is found by this method to become less and less and gradually more and more mineralized, until when it has reached the last tray no putrescible organic material is left. It shows what aeration and, consequently, oxidation, does, but it is not practicable on a large scale for sewage treatment. Several devices have been put forward to apply this principle on a working basis. The system of Prof. Stoddart has met with most favor. It is said that by this method it is possible to treat 5,000,000 gals. of crude domestic sewage each twenty-four hours on one square acre of bed four feet thick. Double the quantity is said to be treatable if the bed be made of double the above depth. Storm water does not affect its treating capacity. It will treat practically all putrescible manufacturing wastes, provided allowance is made for the quantity of organic matter that is present over and above what is the content of a domestic sewage. It has been found better to apply the sewage after a preliminary septic treatment.

The whole process depends on an uninterrupted supply of oxygen. The construction of the plant is very simple. The filtering material may be various, so long as it is coarse, hard and rough, like clinker, coke, broken brick or stone, the pieces to range in size from two to three inches, and uniform in size throughout the filter. The cheapest on the spot is best.

This is placed on a floor of concrete, with such a slope that water will not rest on it at all. There must, in consequence, be no dust or dirt in the filtering material, as this would hinder the free outflow from the bed. The sewage must be distributed continuously in a fine rain. Prof. Stoddart's distributer is constructed for this purpose. It is made of a series of narrow shallow troughs, notched at the edges to allow of overflow; at the bottom edge nails or iron points are arranged so as to break up the stream.

If it could do what is claimed for it, we should have no more difficulty in treating sewage.

We experimented with a two square yard one, four feet deep, at Berlin. The material was rough clinker, well washed; the outflow was free. The distributor delivered a rather coarse stream on to the bed. It hardly came up to our expectations. The odor about it was always bad. The albuminoid ammonia and oxygen consumption was almost not at all reduced in quantity. By Kjeldahl method the nitrogenous content was reduced. Grossly, there was a decided change. The brown color of the tannins was changed. The sewage, though, having considerable fine suspended matter in it when flowing on the bed, came away quite flocculent, the flocculi soon settling, leaving a fairly clean-looking effluent, which, though, was still putrescible. I think it would hardly be possible to run this method in our winter climate.

On the whole, we were much disappointed with the results.

No other continuous method has done better than this one. Some of the towns in England where this method has been worked with have had very little success with it. The results at Horsfield are claimed to be very satisfactory.

It has hardly proved itself one way or the other yet.

(j) Electrolytic Method. Much was promised for this method. It is all right to the extent of what comes in contact with the plates, but what does not passes on without treatment. The method as now constituted is expensive. To a great extent, it merely puts off the evil day, and so far has not been a success.

Profit cannot be made out of any sewage disposal system at present in vogue. But the outlay is not so great to dispose of the waste, as it was for obtaining drinking water.

Report of Work Done at Berlin, Ontario.

The first visit made to Berlin was on March 28. The five days were spent visiting twenty-three of the town's factories. Thirteen of these were found not to give any waste beyond domestic sewage to the system. These thirteen factories included, a glove works, two leather shoe factories, one felt boot factory, a biscuit factory, two iron foundries, three furniture factories, a chemical works, one cloth button factory, and a white goods factory. Ten factories were found to give wastes to the system, peculiar to themselves, and of sufficient importance to be considered separately with reference to their influence on the system. Of these ten factories, there were four tanneries, one gas-works, one brewery, one wool and felt mill, one shirt factory, and, finally, one rubber shoe factory. The following are the findings of these investigations:

1. Rubber Shoe Factory. Here twelve thousand gallons of water is used, some supplied by the town, and an additional quantity pumped by themselves from an artesian well. The crude rubber is crushed and washed in water, merely gravel and coarse vegetable matter, leaves and twigs coming away. All the rest of the process is a dry one. Nothing of a chemical nature of any kind is thrown into the sewers. The water, other than that used to wash the crude rubber, is used for the purpose of cooling the rollers only. The artesian well water here has at times a very strong sulphide odor. No organic waste, then, beyond a domestic sewage comes from this factory.

2. The Shirt Factory. No dying whatever of goods is done here. The goods are made up and then laundered. In this process a large quantity of soap is used. About 12,000 gals. of water a day are taken here. About

the only thing to consider from here is the fat from reduced soap and from the fresh goods, and is not thought to be of such moment as to require any form of treatment at the factory.

3. The Button Works. Here, besides making buttons, a quantity of them are dyed. During the year, a carboy of hydrochloric acid, a small quantity of sulphuric acid, oxalic acid, bichromate of potash, sulphates of iron and copper, and not more than five pounds each of the various aniline dyes are used. The effluent is generally hot, nearly all the dye is exhausted befor being discharged into the sewers. Nothing here at the present time, and in the present quantities used, would cause any serious hindrance to bacterial treatment of the sewage. It is all lost very soon by dilution with the sewage.

4. The Wool and Felt Factory. Foreign and domestic wool, in the raw state, are made up into yarn and woollen goods and felts. Wool rags are also used in the process. Anything infectious in the finished wool is removed by the process. There is nothing, though, to prevent bacteria unkilled passing into the sewers during the preliminary washings given to the rags and raw wool. In washing, and afterwards in fulling, a considerable quantity of soap, sodium carbonate and certain ammonia soap compounds are used, extracting a considerable quantity of fats. No attempt being made to retain them, they go right into the sewer. A great part of the yarns and felts made are dyed on the premises. In the process the greater part of the dyes are exhausted; what goes into the sewers is negligable. The fats from the washing and filling in this factory should be held back from the sewers. A storage basin, giving time for settlement of the sludge, and baffled on the upper surface to catch the fats, would serve the purpose here, and pay for itself probably in the fat held back. What would then go down would be of little consequence.

5. The Brewery. The only waste from here to the sewers is washings from the kegs, barrels, bottles and floors. Considerable finely divided vegetable matter gets into the sewers in this way, and reaches the disposal works. All this material is very tardily putrescible, and is apt to sludge up the beds. Barley husks in considerable quantity may be found at times on those beds receiving crude sewage. With a little care, fine screens would hold this back.

6. The Gas Works. Gas is made here from the volatilization of partly exhausted crude petroleum, scrubbed with water, and freed of considerable of the sulphur compounds by passing over slacked lime. During the scrubbing, the heavier oils are reprecipitated, as it were. It is not as harmful, from a chemical standpoint, to the life of bacteria as the product from coal gas. It appears to be chiefly harmful in that, mixing with particulate mat- such as hair, etc., it blocks the sewers, but on filter-bed surfaces one could hardly conceive of anything worse. It scums over the surface, prevents almost absolutely any entrance of oxygen into the bed underneath, and thus defeats seriously aeration, one of the most important parts of a sewage disposal plant, whether broad irrigation, intermittent sand filtration, or, especially, contact-beds.

The creosote substances remaining in solution in the effluent from the works are soon rendered inert by dilution with the sewage. The heavy oils, though, entering and settling at the bottom of the septic tank, may give off a sufficient quantity of antiseptic to, at least, cripple the bacteria in their functions.

A very slipshod attempt is made to hold back these heavy oils at the works; but this summer they were particularly careful, for only on two or three occasions did they allow any very appreciable amount to come down. But coming down once in a while is still very damaging to any disposal plant. This material is practically non-decomposable. Proper settling tanks, baffled on the surface and at the bottom, if properly looked after at the works, would hold back all this substance. A double set of such tanks should be provided, so that the course of the effluent could be directed to one set whilst the other is being cleaned out. Otherwise, in the process a sufficient quantity to do harm will be certain to escape. If a system of pumping the sewage is finally adopted, this tarry substance will be found still harmful in another way unless the pump be a centrifugal one. The pistons will become fouled, and considerable damage may be done. In one of the cities visited in the Eastern States such a settling tank was introduced at the gas-works, where, so long as care was taken to clean it out regularly and carefully enough to prevent tar getting into the sewers, all went well. Any negligence was immediately felt at the disposal works. In spite of protests, once in a while tar would come down, giving a good deal of trouble, especially with the pumping plant. Finally, the town obliged the gas-works company to seek their own outlet for their sewage, prohibiting entrance into the sewers.

7. The Tanneries. There are four tanneries discharging their wastes into the sewers. Between the four, about 150,000 gals. of sewage, at a low estimate, is being run into the sewers each twenty-four hours during week days. Three classes of leather are produced—harness leather, sole leather, glove and shoe-top leather—and three processes are in operation. For glove and shoe-top leather the chrome tanning method is used, and between the two factories using this about 20,000 gals. of effluent is discharged each day. They use between them 70 and 80 carboys of hydrochloric acid in a year, with the necessary amount of potassium bichromate. This substance, the "chloride of chrome," is decidedly antiseptic, and would stop bacterial action; but, fortunately, most of it is exhausted before it reaches the sewers, and, when it does, it is diluted to such an extent that it does little harm.

Both of these factories use moist hides in the process. The hides are first washed and soaked in water. This water is sent into the sewers. There is nothing to prevent pathogenic organisms going on, although, after the liming process that the hides are next subjected to, such organisms are probably killed. These tanners disclaim absolutely using any arsenic in this liming process, though in the Eastern section of the United States such large quantities of sulphide of arsenic are used that, even diluted, it comes to be dangerous. If used as there used, this arsenic would be antiseptic and harmful to any bacterial system of disposal. The lime itself is useful in the sewage, in that it helps to keep it neutral and acts as a precipitant; but, unfortunately, a considerable quantity of it settles in the sewers and gives rise to a good deal of trouble. The third part of the process, the chrome treatment, would destroy any pathogenic bacteria present. The chrome is practically all taken up by the leather, and very little of it goes into the sewers. In this process there are, thus, three classes of effluent, the hide washings, the lime and lime washings, and, finally, the chrome liquor. All these at present are sent into the sewers at different times, and, of course, in varying quantities. The damage done could be greatly neutralized by mixing the whole twenty-four hours sewage, and allowing it to stand; there would settle out a considerable sludge, carrying down a very large percentage of the organic matter present, from 30 to 50 per cent. of it. This would mean a great saving in the way of disposal plant, and, besides, would remove a great deal of the most obnoxious of the materials given to the sewers by this method. The expense to the manufacturers would be very little, as the plant itself would be simply tank capacity enough to hold the twenty-four hours' sewage. The chemicals would precipitate one another, a comparatively innocuous effluent would leave the place. They, of course, would have to carry away the sludge, and their tanks would have to be constructed so that this could easily be taken out of them. Some return could be made from the sale of the fats gathered at the surface by the baffle-boards, and these fats form no negligable quantity either. It would pay to hold and render them.

Sole-leather is manufactured from moist and dry hides. Most of the dry hides of these come from foreign countries, chiefly Argentina. "Fallen hides" are unavoidably amongst them. These are dangerous. Of course, all these animals have not died from communicable diseases; unfortunately anthrax hides sometimes find their way amongst them. Two tanneries in Berlin are tanning sole-leather. In the case of the moist hides, after washing and soaking in water to rid them of dirt and common salt, they are placed in a lime paste to loosen the hair. They are then washed in water, a good deal of the lime going down the sewers. They are then rid of hair, and treated with an acid, chiefly Sulphuric, and put into a hemlock back leach, to spend from four to six months in it. This letch is used over and over again, sometimes for two years. The hides after coming out of this are washed in water, the waste going into the sewers. In the smaller of the tanneries the spent letch is sent off into the sewers; at the larger one, and it is very acid here, it is sent off by another route, not entering the sewerage system of Berlin.

When the dry hides are used, they are previously soaked in water to soften them and to get rid of the small quantity of arsenic attached, which has been put there when packing, out of a watering can, to inhibit the growth of moths, etc. It is not sufficient in quantity to act as an antiseptic to the hide. Dr. Ellis says there is so little arsenic present in the vats in which this soaking takes place that cattle could drink the water without getting enough to produce any symptoms of arsenical poisoning in them. This arsenicated water goes into the sewers. It cannot do any harm there, except as a carrier of pathogenic bacteria.

The hides from this are again washed, and finally sweated in a warm room to loosen the hair. After removal of the hair, the hides are placed in an acid solution, and then into the hemlock leach vats. Up to the acid treatment there is nothing to kill pathogenic bacteria. From that out, probably, this takes place, viz., during the acid and tannin treatment. From this place the only tannin solution going into the waters is that washed off the hides after they are taken out of the vats. And this is fortunate for Berlin's sewage disposal plant, for what they send out by their own private methods is extremely acid, and would be decidedly harmful in the sewage. Milk of lime hardly neutralizes it, except when used in great excess. A great waste of acid is going on here. A large quantity of water is used at this place, and nine-tenths of it goes into the sewers. They make an attempt to hold back the coarse solids at least, but considerable fine suspended matter gets away to the sewers. This could be held back as well as the fats by a settling basin, without anything further, except to hold the whole twenty-four hours' supply. A very large sediment forms in a standing bottle of this sewage.

In the manufacture of harness leather, moist hides entirely are used. These have been cured in common salt. The hides are washed, treated to lime paste, no arsenic, and the hair removed. They are then placed in a bark leach and changed from vat to vat over months of treatment. The tannins are not used for as great length of time as in the sole leather process. The sewers get the benefit. Usually some one vat is emptied each day, but more especially on two days of the week. These tannin liquors are objectionable, more from the aesthetic than from any other point of view. Nearly all the ground waters about Berlin contain iron, and, of course, blackening takes place as soon as the mixture with this tannin is brought about. The septic tank and the best of the contact-beds removed the greater part of these tannins. These tannins are chiefly responsible for the "huckle-berry milk" color which Schneider's Creek water assumes when the sewage enters it. The purplish black precipitate is made up of tannates and gallates, etc., of iron. Hydro-chloric acid will dissolve them up, and they then give a beautiful iron reaction with Pot Thiocyanate. The effluent from this tannery is of three kinds, washings from the hides, lime liquor and tannins in solution. All of these come at different times of the day. We found, experimentally, that the tannins were lost, to an extent, and the organic substances reduced by from 35 to 40 per cent. by merely holding all the effluents together in the one receptacle for twenty-four hours, a considerable sludge settling to the bottom.

No form of settling tank for any of the tanneries with a less capacity than that of the twenty-four hours would be sufficient to be of any value in sedimenting this sewage.

I have found a willingness in all these tanneries to do all that would be required of them to reduce the difficulties from any cause on their part, even to go to the extent of pumping their sewage into such tanks as would be found necessary. There is a glue works, which does not give any effluent to the sewers, however.

After this inspection of the factories was made, the trip to the Eastern States was undertaken. The sewage plants visited were those at Boston, at Andover, at Clinton, two at Hopedale, at Brockton, at Worcester, at Framingham, and the Experimental Station at Lawrence. The greatest kindness was shown me at each of these places, and every facility given me to learn what there was to be learned at each place; and a good deal of inside information was got. Intermittent sand filtration is the favorite down there, and they have good reason in their preference. It shows the best effluent; they have plenty of sand, the labor is small, and need not be over-skilled, though several of these plants have technically trained men in charge of their plants. The plants work about as well in summer as in winter. They have not taken very kindly to the septic tank preliminary treatment. Probably necessity has not driven them to it. Where they have been installed, except at Andover, they are well satisfied, yes, more than satisfied, with the results. At Lawrence, the work is still being faithfully pushed on at the present time, especially along the line of sewage disposal, and there especially with the different bacterial methods, septic tanks, "contact" beds of various kinds of "continuous" and "intermittent" filters. At the time of my visit, six skilled men were working here, besides the unskilled labor about the place. It is a little hive of enthusiasm.

(8) Average Daily Flow at Berlin. This was measured during dry weather and by weiring at the disposal plant. Readings were taken every hour on eleven different days, and showed the quantity arriving during each twenty-four hours to be approximately 450,000 gals. In appearance it varied at different times during the day. From seven to nine o'clock it looked like ordinary domestic sewage, more like dirty dish water than anything else.

From nine until eleven o'clock it became quite reddish in color from the large quantity of tannins contained; from eleven until about two in the afternoon, it became whitish, apparently from lime-admixture; from then on it usually showed more or less brownish red coloration to about five or six o'clock, when it gradually became cleaner and less colored, so that at nine or ten o'clock at night it became the clearest and least colored of the day, and is said to remain so during the night, when hardly enough to overflow the large septic tank ran over.

In Berlin there is a special surface drainage system, carrying off surface water and storm water. The four tanneries together give about 150,000 gallons of waste water a day to the sewers. The gas works gives from 12,000 to 15,00 gals. The rubber works sends in about 12,000 to 15,000 gals. per day also. The other factories together give about 20,000 gals. Altogether the factories make up about 200,000 gals., leaving thus about 250,000 gals. of domestic sewage. The population of the town is above 10,000. Not all the town is sewered.

(9) Composition of the Sewage. Thirty-three samples were examined from June 26 to Sept. 4. These were aliquot portions from hourly samples taken at the disposal works from main effluent, on the days indicated in the

Raw Sewage at Berlin.

(Parts in 100,000.)

1902.	Total free ammonia.	Total albumenoid ammonia.	Oxygen consumed.	Chlorine.	Color.
June 26th	3.000	1.500	31.50	....	Red.
" 28th	3.450	1.890	16.90	....	"
" 30th	3.885	2.856	69.80	....	"
July 1st	4.788	4.410	27.43	....	"
" 2nd	2.772	1.092	22.37	....	Greyish.*
" 3rd	3.780	3.024	43.40	....	Red.
" 5th	2.520	2.590	21.50	....	No color.
" 8th	2.100	2.016	63.00	....	Red.
" 9th	1.620	1.600	49.70	....	Little color.
" 11th	1.640	1.320	66.20	....	Red.
" 12th	1.960	1.680	51.00	....	"
" 15th	2.530	2.560	49.80	30.0	"
" 16th	2.120	1.460	56.10	86.0	"
" 19th	2.220	1.960	58.60	40.0	"
" 23rd	2.660	2.280	28.40	88.0	"
" 29th	1.360	1.310	52.90	....	"
Aug. 8th	2.400	1.450	43.40	....	"
" 9th	2.300	1.450	55.80	....	"
" 15th	2.600	2.600	....	....	"
" 16th	2.600	2.300	....	....	"
" 19th	2.325	1.600	....	....	"
" 20th	2.100	1.650	40.80	....	"
" 21st	2.450	1.750	78.80	....	"
" 22nd	2.225	2.250	54.80	....	"
" 23rd	2.475	2.025	72.80	....	"
" 26th	2.700	2.700	49.00	....	"
" 27th	2.675	1.660	59.60	....	"
" 28th	2.925	1.625	52.40	....	"
" 29th	2.150	1.925	85.80	....	"
" 30th	2.750	2.200	45.80	....	"
Sept. 2nd	1.900	2.050	....	....	"
" 3rd	2.800	2.100	....	....	"
" 4th	2.100	1.750	....	....	"
Averages	2.542	2.017	49.95	61.0	....

* Public holiday.

subjoined table. These samples were always brown in color except on public holidays and Sundays, and showed considerable sediment from 1-30 to 1-25 of the column. The odor was generally stale and did not vary much. The reaction was never found to be anything but neutral, phenolpthalin, methyl organ, red and blue litmus being used as indicators. Chemically it showed the subjoined composition per 100,000 parts: Free ammonia, 2.542; albuminoid ammonia, 2.017; oxygen consumed, 49.95; chlorine, 61.00.

This on passing into Schneider's Creek blackened almost immediately, due to a fine precipitation of tannates, etc. This precipitate was found to be soluble in hydrochloric acid and to then show a distinct iron reaction with potassium thyocyanate. The water above the sewage farm in Schneider's Creek showed iron to be present. Any of the ground waters about the disposal plant and anywhere else about Berlin that were taken showed iron. Any of the sewage that had run through the town beds showed distinct blackening. None of that from our beds showed it until after some weeks of sewage application. No sewage coming from the septic tanks even showed any appreciable amount of blackening.

(10) Water of Schneider's Creek. During the comparatively dry times the flow of this creek showed about 1,000,000 gals. per 24 hours. Above the sewage disposal plant the water was nearly clear, and showed the following chemical composition per 100,000 parts: Free ammonia, .035; alb. ammonia, .045; oxygen consumed, 3.5; chlorine, 1.0. Below the plant it was invariably blackish in color, sometimes very black and showed the following composition per 100,000 parts: Free ammonia, .875; alb. ammonia, .225; oxygen con., 62.0; chlorine, 18.0.

(11) Uptown Septic Tanks. These tanks (two of them) were placed one above the gas works, the other below, for the purpose of finding if the effluent of the works acted harmfully towards bacterial growth and might thus hinder the treatment of Berlin's sewage. They were started on May 27th. The experiment ceased September 18th.

These tanks were each of 600 gallons capacity, containing a depth of three feet of sewage and being four feet wide. They were each divided into four equal parts by baffle boards dropping down from above and extending up from below, leaving a space between them of about six inches, the space being about one foot below the surface of the sewage and extending all the way across the tank, with the object of holding the sludge at the bottom and the scum above, at the same time allowing the current to run through continuously with little disturbing influence. The rate of flow was about 1,200 gallons per 24 hours for each tank. During the experiment the first compartment, half of the second and about one inch of the bottom of the third filled with sludge. The odor was never bad. Bubbling was always sluggish, and did not commence until June 28th (season was cool), and with the exception of the first compartment the scum was not marked. There was practically no difference in appearance between the two tanks, except that the color below the gas works always seemed better, probably accounted for by the dilution.

From seven a.m. until six p.m., when samples were collected, half hour quantities of affluent and effluent were taken and kept separate. Of these aliquot portions were taken for examination. And in making the examination it was made on unfiltered specimens.

The tank above the gas work removed 40 per cent. of the albuminoid substance and 22.97 of the oxygen consuming material, whilst that below there removed 38.5 per cent. of the albuminoid and 38.4 per cent. of the oxygen consuming substances. The sewage entering the upper tank was not so diluted as that below, but on the whole the difference is small when allowance is made for difference in affluent, but that difference is in favor of the upper tank, in the albuminoid substances, the more important of the constituents of the sewage. The difference though shows that the gas works effluent is not favorable, but that it is not so to any great extent. The sewage containing it is treatable bacterially at least by anaerobes. The following tables will show the composition of the affluents and effluents for each tank. The averages of these speak for themselves:

Septic Tank Above Gas Works.

(Parts in 100,000).

1902.	Affluent.			1902.	Effluent.		
	Free ammon.	Alb. ammon.	Oxygen consumed.		Free ammon.	Alb ammon.	Oxygen consumed.
June 27th	3.465	1.890	16.79	June 27th	3 570	2.380	16.43
" 28th	3.360	2.520	....	" 28th	2.835	1.470	....
" 30th	3.885	2.856	69.80	" 30th	3.150	1.686	64.90
July 1st	4 788	4.410	27.43	July 1st	4.620	2.268	15.90
" 3rd	3.780	3.024	43.40	" 3rd	2.940	1.590	28 50
" 5th	2.520	2.590	21 50	" 5th	3.150	2.180	12 30
Sept. 18th	....	2.950	....	Sept. 18th	....	1.100	....
" 19th	2.850	3.025	....	" 19th	3.250	1.650	....
" 25th	1.850	1.625	....	" 25th	2.150	0.925	....
" 26th	....	2.050	....	" 26th	....	.900	....
Averages	3.312	2.694	35.78	Averages	3.208	1.614	27.60

Change in color throughout.

Capacity of tank 600, run at rate of 1,200 gallons per 24 hours.

Septic Tank Below Gas Works.

(Parts in 100,000.)

1902.	Affluent.			1902.	Effluent.		
	Free ammon.	Alb. ammon.	Oxygen consumed.		Free ammon.	Alb. ammon.	Oxygen consumed.
June 27th	3.045	1.417	18.95	June 27th	3.156	1.417	12.24
" 28th	3.780	1.995	....	" 28th	....	....	....
" 30th	2 940	2.782	37.50	" 30th	2.410	1.260	32.50
July 1st	3.150	2 856	23.46	July 1st	3.570	1.848	16.60
" 3rd	2.360	2.688	40.20	" 3rd	2.520	1.512	14.80
" 5th	2.390	2 590	16.70	" 5th	2.520	1.340	8.50
Sept. 18th	....	2.075	....	Sept. 18th	....	1.275	....
" 19th	2.925	1.400	....	" 19th	2.850	1 375	....
" 26th	....	2.300	....	" 26th	....	.950	....
Averages	3.084	2.231	27.36	Averages	2.837	1.372	16 86

Reduction of color always.

Capacity of tank 600 gallons, running at rate of 1,200 gallons per 24 hours.

Results in the Septic Tanks.

In conducting these experiments two tanks were used: one, the tank two years before constructed by the town, with a total capacity of 60,000 gallons, the other one of 1,800 gallons capacity. The smaller tank was a duplicate of the same construction as those uptown in construction and division of compartments, and with the same arrangements of baffle boards. The larger one, as may be seen by the subjoined print, had baffle boards running down from the surface only. The baffling in the small tank was much more successful in arresting suspended matter than that in the large tank, even when making allowance for the difference in flow. The sludge in the smaller tank filled the first chamber and about one foot of the second. There was not more than an inch or two of it in the third. In the large tank all of the grit or first chamber was filled, the proximal floor of the rest did not show more than about 6 or 8 inches of sediment. Both tanks were started on June 26th, the experiments with them ceased on Sept. 4th, when these sludge measurements were made.

The flow through the small tank was continuous, and at the rate of 1,800 gallons per day throughout the experiment. The following table will show the average affluent with the effluent date by date, with the general average of each at the end of the experiment. The average percentage treatment here was for albuminoid substances 53.0, and for oxygen consuming materials, 51.7.

This occurred curiously enough without the production of any unpleasant odor. The gas production was never extremely vigorous, nor was scum formation marked, but compared with the affluent the effluent had lost a considerable quantity, as much as 3-4 of its coloring matter:

Small Septic Tank at Farm.

(Parts in 100 000)

1902.	Affluent.			1902.	Effluent.		
	Free ammon.	Alb. ammon.	Oxygen consumed.		Free ammon.	Alb. ammon.	Oxygen consumed.
June 26th	3.000	1.500	31.50	June 26th	2.500	1.062	11.74
July 8th	2.100	2.016	63.00	July 8th	1.785	1 210	42.80
" 9th	1.620	1.600	49 70	" 9th	.850	.880	19.80
" 11th	1.640	1.320	66.20	" 11th	.850	.840	22.10
" 16th	2.120	1.460	56.10	" 16th	1.180	.740	21.90
" 29th	1.360	1.310	52.90	" 29th	1 620	1.250	31 60
Aug. 8th	2.400	1.450	43.45	Aug. 8th	2.800	1.150	28.40
" 9th	2.300	1.450	55.80	" 9th	3.000	.750	13.20
" 15th	2.600	2.600	....	" 15th	2.400	1.000	....
" 16th	2.600	2.300	....	" 16th	1.500	.575	....
" 19th	2 325	1.600	....	" 19th	2.050	.675	....
" 20th	2 100	1.650	40 80	" 20th	2.075	.975	32 00
" 21th	2.450	1 750	78.80	" 21st	2.350	1.150	23.60
" 22nd	2.225	2 250	56 80	" 22nd	1 375	.760	39.60
" 23rd	2.475	2 025	72 80	" 23rd	1 705	.700	29.60
" 26th	2.700	2.700	49 00	" 26th	2.075	1.025	30.20
" 27th	2.675	1.600	59.60	" 27th	1.800	1.050	20 20
" 28th	2.925	1.625	52.40	" 28th	2.125	.975	37.20
" 29th	2.150	1.925	85 80	" 29th	1.825	.850	30.80
" 30th	2.750	2.200	45.80	" 30th	2 100	.925	33.80
Sept. 2nd	1.900	2.050	....	Sept. 2nd	2 550	.550	....
" 3rd	2 800	2.100	....	" 3rd	2 450	800	....
" 4th	2.100	1.750	....	" 4th	2.475	1.050	....
Averages	2 317	1.835	57.08	Averages	1.966	.860	27.56

Capacity 1.800 gallons. 1,800 gallons run through per 24 hours.

The Large Septic Tank.

The large septic tank had just been emptied of sludge when the experiment began. It did not show any advantage over the smaller one in the time of commencing treatment. Bubbles appeared on both about the same time after the warm weather began. Seeding here, apparently, at least, had no advantage. Of course there must be taken into account the much larger bulk of sewage. The resting place for the bacteria being the surfaces of the tank and the contained sludge, the fluid moving out rapidly gave them much less chance to perform their work. This tank, whose capacity was 60,000 gallons, was run at the rate of 100,000 gallons per 24 hours. There was no odor. The removal of color was never as good as in the smaller tank, and there was always more suspended matter in its effluent than in the smaller tank. The bubbling was about the same in both. There was very little scum—hardly as much as in the smaller tank.

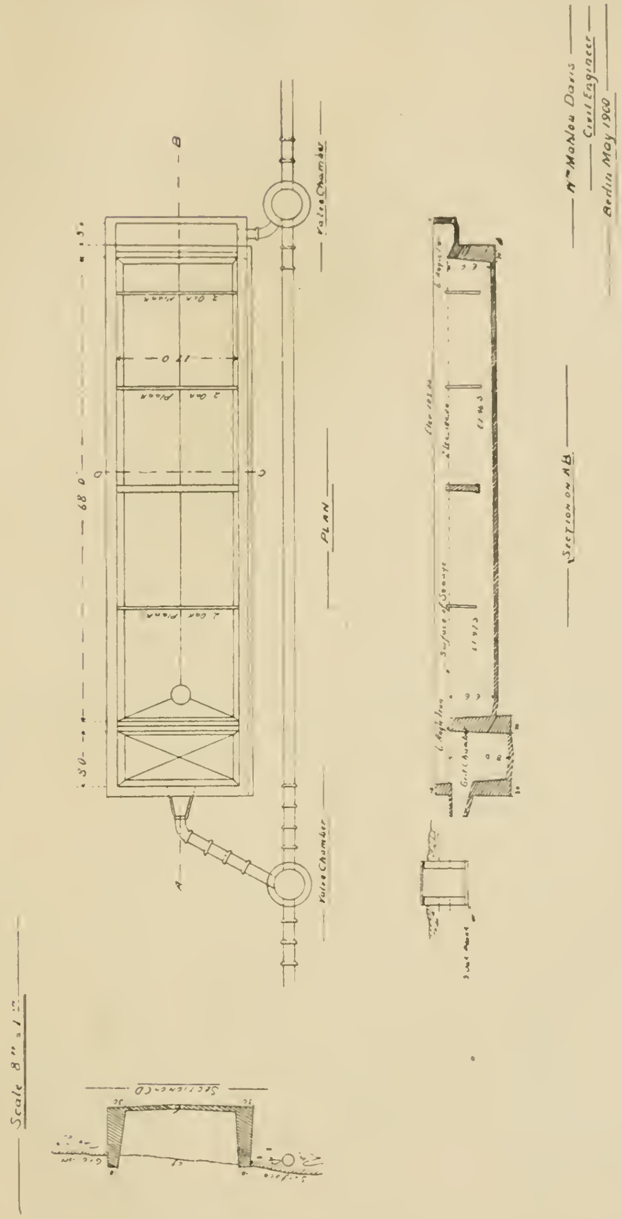
In the following table will be found the chemical composition of the affluents and effluents throughout the experiment. The average percentage treatment here was for albuminoid substances, 45.5, and for oxygen consuming substances, 40.6.

Large Septic Tank.

(Parts per 100,000)

1902.	Affluent.			1902.	Effluent.		
	Free ammon.	Alb. ammon.	Oxygen consumed.		Free ammon.	Alb. ammon	Oxygen consumed.
June 26th	3.000	1.500	31.50	June 26th	3.000	1.375	10.45
July 3rd	....	....	... .	July 3rd	2.940	1.260	19.47
“ 8th	2.100	2.016	63.00	“ 8th	1.800	1.176	47.10
“ 9th	1.620	1.600	49.70	“ 9th	1.357	.874	18.50
“ 11th	1.640	1.320	66.20	“ 11th	1.270	.864	16.20
“ 12th	1.960	1.680	51.00	“ 12th	1.160	1.190	53 70
“ 15th	2.530	2.560	49 80	“ 15th	1.820	1.260	40.40
“ 19th	2.220	1.900	58.60	“ 19th	2.240	1 240	38.30
“ 23rd	2 660	2.280	28.40	“ 23rd	2.140	1.160	25.00
“ 29th	1.360	1.310	52.90	“ 29th	.980	.728	21.00
Aug. 8th	2.400	1.450	43 40	Aug. 8th	2.450	.950	28.60
“ 9th	2.300	1.450	55.80	“ 9th	1 900	.650	26.60
“ 15th	2.600	2.600	....	“ 15th	2.100	1.350	....
“ 16th	2.600	2.300	....	“ 16th	2.200	.950	....
“ 19th	2 325	1.600	....	“ 19th	2 975	1.050	....
“ 20th	2.100	1.650	40 80	“ 20th	2.250	1.175	28.80
“ 21st	2.450	1.750	78 80	“ 21st	2.475	1.125	39.10
“ 22nd	2.225	2.250	54 80	“ 22nd	1.750	1.265	49.00
“ 23rd	2.475	2.025	72.80	“ 23rd	2.175	.950	36.80
“ 26th	2.700	2.700	49.00	“ 26th	2.650	.925	49.75
“ 27th	2.675	1.600	59.60	“ 27th	2.650	1.150	32.00
“ 28th	2.925	1.625	52.40	“ 28th	2.650	1.100	36.60
“ 29th	2 150	1.925	85 80	“ 29th	2.250	1.025	34.00
“ 30th	2 750	2.200	45 80	“ 30th	2.900	1.025	28 60
Sept. 2nd	1.900	2.050	....	Sept 2nd	3.250	925	....
“ 3rd	2.800	2.100	....	“ 3rd	3 050	.775	... .
“ 4th	2.100	1.750	....	“ 4th	2 250	.925	....
Averages	2.329	1.930	54 48	Averages	2.223	1.057	32.37

Capacity, 60,000 gals. 100,000 gals. run through each twenty-four hours.


BERLIN SEWAGE DISPOSAL WORKS Large Septic Tank.

There is thus a difference of 7.5 per cent in the removal of albuminoid substance and 10.1 per cent. of oxygen consuming material in favor of not running a septic tank at Berlin above its capacity for the 24 hours. It would seem enough to repay the outlay made in supplying more tankage capacity.

The treatment obtained in both these tanks shows that septic tank treatment here is very well up to the best obtained at other places. The advantage in our experiments here was that both tanks were large, especially the larger one, and we were able to get results more nearly approaching what might be expected in the practical disposal of sewage.

Contact Beds.

There were four of them. Three of these had contact material of gravel and were covered to a depth of 3 inches with a coarse, sharp sand to screen affluent. The gravel in each of the three beds was of different sizes. This was done with the idea of seeing what difference size of material would have in the treatment obtained. The gravel was screened quite clear of sand and dirt of any kind. It was placed in each bed in a three-foot deep layer, the bottom of the bed being underdrained with 4-inch tile, coarse gravel being placed around the tile in a layer about 2 inches thick. These three beds had each an area equal to one two-hundredth of an acre. The banks and bottom of the beds were of clay, fortunately found in situ; any sandy seams present were dug out and tamped well with clay to prevent leakage. Boxes with sliding gates were placed to control the effluents. These three beds were finished and started on July 8th, the experiment with them was continued until Sept. 4th. It was nearly two weeks after starting before they commenced to remove the tannin color of the affluent, which had been always in the effluent of the large septic tank.

The bed with the smallest material was the first to change the tannins and always did it best, the least efficient of the beds being that with the coarsest gravel. In the effluent of this last there was always left a certain tannin coloration. Consultation of the subjoined tables will show the interspace capacity of each bed, the rate at which run and the composition of the affluent and the effluent from date to date and at the end the averages of each. At no time was the effluent from any of these beds non-putrescible. The bed with the finest gravel gave always the best effluent, the coarsest the least treated, though the nitrate results were best in the coarsest bed when they were made.

During the first part of the experiment the beds were filled 3 times each day, during the second period only twice a day. It will be noted in the tables that there is no appreciable difference in the results of the treatment, whether two or three applications a day were made. The sand on the surface of the beds had to be raked over every few days otherwise it was found that the sewage could not go down into the beds. In collecting the samples, the affluents were sampled three times whilst running on, the effluents were taken three times whilst running off. The results from the three cycles or two as the case might be, were mixed together, affluent with affluent, effluent with effluent and aliquot portions taken for examination.

The interspace capacity of all the beds was probably reduced during the experiment. No. 1 showed a reduction of one-eleventh. It was the only one measured.

The percentage reduction in each bed over affluent was:

	Free ammonia.	Albuminoid ammonia.	Oxygen consumed.
No. 1	40 per cent.	34 4 per cent.	51 per cent.
No. 2.............	30.3 "	42.3 "	51.7 "
No. 3.............	33.6 "	27.8 "	44 5 "

The best bed leaves an average effluent showing per 100,00 parts:

Free ammonia.	Albuminoid ammonia.	Oxygen compound.
1.562	.592	16.43

Thus there is shown a percentage reduction from the crude sewage of:

Free ammonia.	Albuminoid.	Oxygen compound.
32.8 per cent.	68.8 per cent.	70.3 per cent.

The septic tank has done more than two-thirds of the work.

Contact Bed I.

1/200 acre. (Parts per 100,000.) Quarter inch gravel.

1902.	Affluent.			1902.	Effluent.		
	Total free ammon.	Total alb. ammon.	Oxygen consumed.		Total free ammon.	Total alb. ammon.	Oxygen consumed.
July 8th	1.785	1.210	42.80	July 8th	1.260	.630	24.00
“ 16th	1.180	.740	21.90	“ 16th	.760	.670	14.90
“ 23rd	2.140	1.160	25.00	“ 23rd	.530	.640	8.70
“ 29th	1.300	1.039	26.30	“ 29th	1.330	.490	27 00
Aug. 8th	2.450	.950	28.60	Aug. 8th	1.400	.650	10.40
“ 9th	1 900	.650	26.60	“ 9th	900	.350	11.20
“ 15th	2.100	1.350	....	“ 15th	1.700	.825	....
“ 16th	2.200	.950	....	“ 16th	1.525	.550	....
“ 19th	2.975	1.050	....	“ 19th	2.250	.600	....
“ 20th	2.250	1.175	28.80	“ 20th	1.475	.700	29.30
“ 21st	2.475	1.125	39.10	“ 21st	1.200	1.100	14.20
“ 22nd	1.750	1.265	49.00	“ 22nd	.950	.555	17.60
“ 23rd	2.175	.950	36 80	“ 23rd	.955	.500	14.60
“ 26th	2.650	.925	49.75	“ 26th	1.525	.775	15.00
“ 27th	2.650	1.150	32.00	“ 27th	1.325	.575	12.40
“ 28th	2 650	1.100	36.60	“ 28th	1.275	.575	12.40
“ 29th	2.250	1.025	34.00	“ 29th	1.575	.550	20.40
“ 30th	2.900	1.025	28.60	“ 30th	....	....	....
Sept. 2nd	3.250	.925	....	Sept. 2nd	2.400	.450	....
“ 3rd	3.050	.775	....	“ 3rd	1.950	.500	....
“ 4th	2.252	.925	....	“ 4th	1.375	675	....
Averages	2.306	1.022	33 72	Averages	1.383	.678	16 59

Interspace capacity 234,400 gals. per acre. Run at three times this rate for first half of experiment per acre per day. Run at twice this rate for second half of experiment per acre per day.

Contact Bed II.

1/200 acre. (Parts per 100,000.) One-eighth inch gravel.

1902.	Affluent.			1902.	Effluent.		
	Total free ammon.	Total alb. ammon.	Oxygen consumed.		Total free ammon.	Total alb. ammon.	Oxygen consumed.
July 8th	1.800	1.176	47.10	July 8th	1.470	.580	19.70
“ 15th	1.820	1.260	40.40	“ 15th	.960	.460	9.10
“ 16th	1.800	1.206	40.04	“ 16th	.660	.560	12 10
“ 19th	2.240	1.240	38.30	“ 19th	640	.680	18.60
“ 23rd	2.140	1.160	25.00	“ 23rd	.780	.800	9.20
“ 29th	.980	.728	21.00	“ 29th	.730	.500	26.80
Aug. 8th	2.450	.950	28.60	Aug. 8th	1.400	.650	11.60
“ 9th	1.900	.650	26 60	“ 9th	.900	.300	8.00
“ 15th	2.100	1.350	....	“ 15th	2 200	.900	....
“ 16th	2.200	.950	....	“ 16th	2.150	.575	....
“ 19th	2.975	1.050	....	“ 19th	2.925	.800	....
“ 20th	2.250	1.175	28.80	“ 20th	1.725	.475	28.70
“ 21st	2.475	1.125	39.10	“ 21st	1.475	.660	15.20
“ 22nd	1.750	1 265	49.00	“ 22nd	1.150	....	21.00
“ 23rd	2.175	.950	36.80	“ 23rd	1 170	.500	....
“ 26th	2.650	.925	49.75	“ 26th	1.725	.700	18.50
“ 27th	2.650	1.150	32.00	“ 27th	1.475	.650	11.60
“ 28th	2.650	1.100	36.60	“ 28th	1.475	.525	12 60
“ 29th	2 250	1.025	34 00	“ 29th	1.675	.575	17.60
“ 30th	2 900	1.025	28.60	“ 30th	2.050	.575	22.60
Sept. 2nd	3.250	.925	....	Sept. 2nd	2.650	.450	....
“ 3rd	3.050	.775	....	“ 3rd	2.800	.550	....
“ 4th	2.250	.925	....	“ 4th	1.750	.650	....
Averages	2.247	1.042	34.21	Averages	1.562	.596	16.43

Interspace capacity, 187,400 gals. per acre. Run at three times this rate for first half of experiment per acre per day. Run at twice this rate for second half of experiment per acre per day.

Contact Bed III.

1/200 acre (Parts per 100 000.) ½-inch gravel.

1902.	Affluent.			1902.	Effluent.		
	Total free ammon.	Total alb. ammon.	Oxygen consumed.		Total free ammon.	Total alb. ammon.	Oxygen consumed.
July 8th	1.800	1.176	47.10	July 8th	1.680	.610	19.10
" 12th	1.160	1.190	53.70	" 12th	.300	.740	26.50
" 15th	1.820	1.260	40.40	" 15th	1.260	.620	17.20
" 19th	2.240	1.240	38.30	" 19th	1.090	1.000	25.90
" 23rd	2.140	1 160	25.00	" 23rd	1.340	.960	15.90
" 29th	.980	.728	21 00	" 29th	1.320	.880	51.30
Aug. 8th	2.450	.950	28.60	Aug. 8th	1.700	.650	10.60
" 9th	1.900	.650	26·60	" 9th	1.000	.350	17.40
" 15th	2.100	1.350	....	" 15th	1.650	.925	....
" 16th	2.200	.950	....	" 16th	1.650	.575	....
" 19th	2.975	1.050	....	" 19th	2 100	1.725	....
" 20th	2.250	1.175	28 80	" 20th	1.425	.575	26.30
" 21st	2.475	1.125	39.10	" 21st	1.425	.825	21.00
" 22nd	1.750	1.265	49 00	" 22nd	1.060	.805	20.00
" 23rd	2.175	.950	36.80	" 23rd	1.225	.750	....
" 26th	2.650	.925	49.75	" 26th	1.150	.650	13.00
" 27th	2.650	1.150	32.00	" 27th	1.350	.700	11.60
" 28th	2.650	1.100	36 60	" 28th	1.400	.800	14.40
" 29th	2 250	1.025	34.00	" 29th	1.700	.675	20.40
" 30th	2.900	1.025	28.60	" 30th	1.975	.700	10.60
Sept. 2nd	3.250	.925	....	Sept. 2nd	2.150	.575	....
" 3rd	3.050	.775	......	" 3rd	2 400	.600	....
" 4th	2.250	.925	....	" 4th	2.200	.850	....
Averages	2 262	1.041	36 19	Averages	1.502	.758	20.07

Interspace capacity, 257,800 gallons per acre.
Run at three times this rate for first half of experiment, per acre per day.
Run at twice this rate for second half of experiment, per acre per day.

Coke Contact Bed.

This was of the same depth as the gravel beds and was constructed and drained in the same way. The coke was of a specially

Coke Bed.

(Parts per 100,009.)

1902.	Affluent.			1902.	Effluent.		
	Free ammon.	Alb ammon.	Oxygen consumed.		Free ammon.	Alb. ammon.	Oxygen consumed.
Aug. 8th	2.800	1.150	28 40	Aug. 8th	2.500	.850	22.00
" 9th	3.000	.750	13 20	" 9th	1.700	.600	49 00
" 15th	2.100	1.350	....	" 15th	2.250	1.150	....
" 16th	2.200	.950	....	" 16th	2.050	.750	....
" 19th	2.975	1.050	....	" 19th	2.560	.975	....
" 20th	2.250	1.175	28 80	" 20th	1.950	1.000	12.20
" 21st	2.475	1.125	39.10	" 21st	1.900	.925	24.60
" 22nd	1.750	1.265	49.00	" 22nd	1.975	1.200	39.20
" 23rd	2.175	.950	36.80	" 23rd	1.700	.725	....
" 26th	2 650	.925	49.75	" 26th	2.625	1.050	24.50
" 27th	2 650	1.150	32.00	" 27th	1.775	1.125	53.80
" 28th	2.650	1.100	36.60	" 28th	2.625	1.125	29.40
" 29th	2.250	1.025	34.00	" 29th	2.150	.975	22.40
" 30th	2.900	1.025	28.60	" 30th	2.900	1.025	15.20
Sept. 2nd	3.250	.925	....	Sept. 2nd	3.000	.850	....
" 3rd	3.050	.775	....	" 3rd	3.400	.600	....
" 4th	2.250	.925	....	" 4th	2.425	1.000	....
Averages	2.551	1.036	33.27	Averages	2.327	.936	29.23

Interspace capacity, per acre, 356,000 gallons. Run at the rate of 712,000 gallons per acre per day.

hard form in pieces of 1 inch in size. It had an area of one-eight hundredth of an acre. It was finished and started on August 8th, and finished with on September 4th. It took a week's working before its effluent showed any reduction of the color of the affluent. The effluent as shown by the subjoined table was not satisfactory. Its interspace capacity was 356,000 gallons per acre, and it was run at the rate of 712,000 gallons per acre per day.

During the week beginning September 15 we tried reapplying the effluent of this bed to it again having pumped it into barrels. Curiously, the second effluents showed more albuminoid ammonia than the first effluent, very like what happened continuously with the Stoddart continuous filter.

Stoddart Continuous Filter. This bed was made of 2 sq. yards area, 4 feet deep of well washed coarse 3-inch hard clinkers, placed on a sloping board foundation, with no walls, except the back one. It was fed with septic sewage from the large septic tank continuously in a rain by an imitation of Stoddart's distributer. Drawings of the bed may be seen by referring to the accompanying scaled sketch of the experimental plant at the disposal farm. The sewage was poured on this at the rate of 5,000,000 gallons per acre per day. The color was rendered black and instead of a fine precipitate as was in affluent, a flocculent one came away with the effluent. The odor about the bed was decidedly offensive. A large growth of low vegetable matter, but not enough to obstruct the bed, soon took possession. The effluent showed more albuminoid ammonia than went into it. A Kjeldahl estimation showed a decrease in the organic nitrogen coming off to that going on, this might possibly be the origin of the increased albuminoid ammonia, the rest having gone off in gases.

In appearance the effluent was certainly changed. It was still putrescible though; but it had lost its tannin color, and after settling showed a pretty clear supernatant fluid. The following table will show what was done in this bed:

Stoddard Continuous Filter.

(Parts per 100,000)

1902.	Affluent.			1902.	Effluent.		
	Free ammon.	Alb. ammon.	Oxygen consumed.		Free ammon.	Alb. ammon.	Oxygen consumed.
Aug. 8th	2.450	.950	28.60	Aug. 8th	2.000	.950	35.60
" 9th	1 900	.650	26.60	" 9th	1.700	1.150	22.40
" 15th	2.100	1.350	....	" 15th	2 400	1.350	....
" 16th	2.200	.950	....	" 16th	2.400	1.150	....
" 19th	2.975	1.050	....	" 19th	3.300	1.550	....
" 20th	2.500	1.400	10.00	" 20th	2.275	.925	13.30
" 21st	2.875	1.000	34 80	" 21st	2.100	1.350	30.40
" 22nd	1.750	1.250	49.00	" 22nd	1.875	1.350	32.00
" 23rd	2.150	1.300	....	" 23rd	2.150	.900	....
" 26th	2 850	1.125	29 50	" 26th	2 550	1.550	23 50
" 27th	2.650	1.150	32 00	" 27th	1.675	.925	27.40
" 28th	2.650	1 100	36 60	" 28th	2.200	1.200	27.80
" 29th	2.550	1.100	36.00	" 29th	2 100	1.650	32 80
" 30th	3.000	1.125	42 00	" 30th	2.000	1.500	46.00
Sept. 2nd	3.050	.750	....	Sept. 2nd	2.350	.675	....
" 3rd	3.050	.800	....	" 3rd	1.550	1.025	....
" 4th	2.450	1.125	....	" 4th	2.050	1.150	....
Averages	2.538	1.069	30.52	Averages	2 151	1 191	29 12

Run at rate of 5,000,000 gallons per 24 hours per acre.

Town Bed.

July 15th	1.820	1.260	40.40	July 15th	1.350	.400	12.80

Sand in Neighborhood of Farm.—The hills in the neighborhood of the farm were visted from time to time in order to determine their composition. Test holes were dug in several places. Sand of an excellent quality was found both in the east and the west of the sewage farm. At a very small depth below the surface not more than from eighteen to twenty-five inches and usually much less. In several of the holes a thin stratum of sandy clay about half an inch thick was found at about 20 inches below the surface of the sand in the hills to the west, but only very few such spots were found in hills to the east of the farm. The sand to the east is decidedly the better. On the surface it seems very fine but after a few inches is quite coarse and sharp. This clay stratum might hinder free aeration of the beds if they should be constructed there.

Many acres more than sufficient to treat twice Berlin's present sewage could be made into beds on these hills.

Tannery Waste. The whole day effluent from the harness leather tannery was examined on five occasions and gave the following average composition per 100,000: Free ammonia, 3.20; albuminoid ammonia, 5.25; oxygen consumed, 122.4. By using an experimental sedimentation by means of two 40-gallon barrels, baffled after the metallurgists' principle, viz., allowing the fluid to enter into a small narrow chamber open at the bottom and leading into a much larger one, the solids rising against the head of water, are more likely to remain at the bottom, from this first barrel the effluent overflowing into a second divided in the same way. The average effluent was as follows in parts per 100,000: Free ammonia, 2.183; albuminoid ammonia, 3.15; oxygen consumed, 111.0, thus showing a reduction of 40 per cent. in the albuminoid substances by a mere sedimentation process allowing the compounds to react on one another, in a simple retention space. The oxygen consuming materials did not show the same or any considerable reduction at all, though the comparative colors of affluent and effluent showed a decided reduction in favor of the effluent.

By using alum on the tannin liquor before allowing it to enter the general mixture with 15 grains of alum to each gallon of liquor an almost complete removal of tannins could be made, with besides an additional reduction of albuminoid substances to the extent of 10.12 per cent. Sulphate of iron gave the same result, but had the disadvantage of producing an objectionable black color in the effluent.

Conclusions Based on Experiments Regarding Berlin's Sewage Disposal Problem.

The average sewage of Berlin shows per 100,000 parts:

Free ammonia.	Albuminoid ammonia.	Oxygen consumed.
2.542	2.017	49.95

The average large septic tank effluent, 60,000 gallons capacity, treating 100,000 gals. per day, shows:

Free ammonia.	Albuminoid ammonia.	Oxygen consumed.
2.223	1.057	32.37

The average small septic tank effluent, 1,800 gals. capacity, treating 1,800 gals. per day, shows:

Free ammonia.	Albuminoid ammonia.	Oxygen consumed.
1.966	.860	27.56

The average of the bed giving best results on treating 562,000 gals. per acre per day shows an effluent containing:

Free ammonia.	Albuminoid ammonia.	Oxygen consumed.
1.562	.596	16.43

A good water should approach the following composition:

Free ammonia.	Albuminoid ammonia.	Oxygen consumed.
.003	.005	.115

A water from peaty soils may contain:

Free ammonia.	Albuminoid ammonia.	Oxygen consumed.
.005	.023	.740

In a stream diluting 3 times a sewage effluent containing:

Free ammania.	Albuminoid ammonia.	Oxygen consumed.
.015	.069	2.220

Might be allowed to enter.

Into a stream diluting 10 times, a sewage effluent containing:

Free ammonia.	Albuminoid ammonia.	Oxygen consumed.
.05	.23	7.400

Might be allowed to enter.

The gas works effluent (gas being made from petroleum), after removal of the tarry products, may be discharged into the sewers.

The tarry material if allowed to enter would render any bacterial oxidation beds useless. Settling tanks, on the gas premises, baffled at bottom and surface, with a capacity of at least a half day's sewage, would hold this back. A small side tank of the same construction should be present to treat it whilst the larger is being cleaned.

The tanneries yield considerable organic matter that could be held back, to as large an extent as 40 per cent. with tank settling capacity equal to the 24 hours sewage flow.

Schneider's Creek, which receives the effluent, is very small, having a dry weather capacity of probably not more than 1,000,000 gallons a day. There is not enough water to dilute the effluent given by septic tanks and contact beds to the recognized standard of a tolerated drinking water.

Enough sandy land to give intermittent sand filtration to all Berlin's sewage for the present and probably years to come can be got in the immediate vicinity of the farm.

To reach such sand pumping would be required. A reservoir to hold the whole 24 hours sewage could be constructed. In this way all the pumping could be done in a few hours.

Septic tanks as an auxiliary could be used in connection with this intermittent sand filtration to reduce the quantity of organic mater to be treated and to the extent of work done would reduce the quantity of land required to purify the sewage to the required standard.

Were such a sand filtration method adopted, the septic tank capacity for the present sewage flow should not be less than 450,000 gallons.

On such sand beds as could be got at Berlin sand filtration elsewhere gives an effluent equal to the required standard. JOHN A. AMYOT.

PART II.

CHAIRMAN'S ANNUAL ADDRESS.

By H. E. Vaux, M.D., Toronto.

February 12, 1903.

To the Members of the Provincial Board of Health :

Gentlemen : On reassembling for this, the first session of the year, it is with sincere thankfulness that, as a Board, we can do so in the enjoyment of health and strength.

The year 1902 has not been marked by any epidemic of formidable character, although certain diseases are, like the poor, "always with us."

As the years roll by and sanitation becomes more of a fixed science, we find that our grasp of the essentials becomes more firm, and consequently results are more apparent and more prompt.

Through the kindness of our Secretary, I am able to lay before you some statistics showing the number of deaths from communicable diseases during the year, based upon a return from 90 per cent. of the population. The total deaths from all causes amount to 25,208, or an average of 12.8 per 1,000. There has been a mortality from tuberculosis of 2,164 ; diphtheria, 444 ; typhoid fever, 363 ; scarlet fever, 282 ; whooping cough, 144 ; measles, 106.

On comparing the number of deaths from contagious diseases in 1901 and 1902, we find a slight reduction on the whole. Thus, in tuberculosis there is a decrease of 122 ; measles, 14 ; diphtheria, 68 ; increase in scarlet fever of 73, and whooping cough, 32.

The cool, wet summer has probably much to do with bringing about this improved condition.

Several valuable reports have been laid before us during the year by the Standing Committees, by Dr. Bryce, and by Drs. Oldright and Cassidy, who attended the Tuberculosis Conferences as our delegates to New York and Ottawa.

I do not intend to do more than call your attention to and ask your careful study of what these reports so fully deal with.

Those on tuberculosis naturally claim first place in view of the heavy mortality. In these reports compulsory notification, isolation, disinfection of rooms lately occupied by consumptives, disinfection of sputum, and generally strict attention to well recognized hygienic measures for the prevention of contagion, at the same time care being taken that public antagonism is not aroused by too radical measures being adopted at first, are all fully emphasized. With this disease the old adage, "prevention is better than cure" is increasingly proved to be true. Almost at the moment that positive assurance is given that tuberculosis is curable, reports come to us from eminent authorities that some apparent cures are only temporary, and that a large proportion of those who fondly hoped that they had conquered their foe have been doomed to disappointment by a return of their malady. While this may be true, yet in our experience, personal hygiene and the hygiene of dwellings, shops, schools, and factories will be found to exercise a far greater influence on the reduction of mortality from tuberculosis than will result from segregation in sanatoria.

The Smallpox situation has certainly vastly improved since I had the honor of presenting my last Annual Address, and the very radical measures adopted in dealing with the sanitation of lumber camps have already, by their results, shown the wisdom of our Secretary's prompt action.

The Committee on Epidemics has also laid before us a report on necessary sanitary precautions, which it is advisable should be observed in barber shops. This is a matter which has forced its attention on sanitarians, and we are glad to know that the barbers are equally anxious, with ourselves, to close every avenue of danger, so far as their shops are concerned. This being the case, it cannot be very long before the excellent recommendations made by the Committee are carried into effect.

The reports of the Committee on Sewerage are of very great importance, and should be given our special attention, more especially the one dealing with Berlin sewage, taken in conjunction with Dr. Amyot's exhaustive report, which was laid over for consideration until this meeting of our Board.

You will remember that in response to the appeal made by the Mayors of several municipalities, the Government consented to conduct a series of experiments last summer in connection with the Berlin sewage farm, Dr. Amyot being placed in charge. It is now for you to formulate such deductions from the results of his work, as may indicate to Berlin and other similarly situated places, some solution of the great difficulties with which they have to contend.

In closing, I would desire to point to some of the results which have been secured by the adoption of better sanitary measures in dealing with sewage in suburban houses, and, in fact, wherever other safe means of disposal cannot be adopted, notably in summer resorts, where it is absolutely essential that the lakes and rivers should not be contaminated.

The report of our Secretary, Dr. Bryce, on this subject in the last Annual Report of the Board, gives his plan in detail, and I am glad to be able to state that it appears to work admirably in practice. Thus, at the Royal Hotel at Muskoka last summer, the sewage, even when the hotel was crowded, was disposed of without any contamination of the lakes, and in the City of Brantford at the Pork Packing establishment from 15,000 to 20,000 gallons per diem is successfully disposed of.

All of which is respectfully submitted.

HARRY E. VAUX,
Chairman.

I. QUARTERLY REPORT OF THE SECRETARY.

Toronto, April 9, 1902.

Mr. Chairman and Members of the Provincial Board of Health :

Gentlemen : Your Secretary begs to report that the general health of the Province during the past quarter has been more than usually satisfactory for the period of year. It has in a remarkable degree been free from those epidemics of influenza, which have, unfortunately, marked so many of the winters during the past twelve years. The month of March shows a decrease in the Toronto returns, while the comparative mortality for the Province as a whole is seen in the submitted Bulletins for January and February. Here and there outbreaks of diphtheria and scarlatina have been reported ; but, except in one area, that of the Parry Sound district, the deaths have not been excessive. An unfortunate outbreak of scarlatina occurred in lumber camps in Hagerman and adjoining townships before Christmas, which was spread by men leaving camp for their homes, and carrying disease with them, resulting in numerous cases, and a considerable number of deaths—in one instance a whole family of six being swept away. The district was visited by the Medical Inspector of the Board, Dr. Hodgetts, and the provisions of the Regulations for Unorganized Districts were enforced, the outbreak having since been suppressed. A serious outbreak of diphtheria, resulting in several deaths in a single house, was reported in March from Denbigh Township, in North Frontenac. Fortunately, with the increasing settlements, medical aid is being brought nearer, as the people on the frontier settlements are becoming better off, and these melancholy accidents are fewer ; but they are still sufficiently frequent to make one wish that medical aid were more available for the poorer people in the sparsely settled districts. During the winter similar reports of smallpox outbreaks in families in Unorganized Territories have been received ; and the problem of how far the interests of victims of the disease and of the general public should be promoted without the Board's directly undertaking to supply medical aid, has caused your Secretary considerable thought. The supervision directly by the Board of the Northern Districts last year led persons to suppose that they had only to report themselves, and that they then could get medical attention supplied ; while the physicians of those districts, naturally thinking it easier to collect fees from the Board than from such patients, have endeavored, in some cases, to have the Board guarantee attendance in private families. The mild type of the disease, has, however mitigated what under other circumstances would have resulted in serious misfortune, and it is pleasing to relate that no fatal results from neglect of such cases have been reported.

Smallpox. The quarter's reports of the prevalence of smallpox have just been completed, and the following statement sets forth the total cases which have occurred in Jaunary, February and March of 1892 :

In January there were 629, in February 707, and in March 302, while the summarized totals since the beginning of 1901 were in all 3,517.

The January report showed that with the start given in the lumbering districts before inspection began in October, a considerable number of cases had broken out in camps, but that they were notably lessening under the strict inspection instituted by your officers, and the general compliance on the part of lumbermen with the regulations requiring them to employ medical men. In all some sixty firms throughout the Province have complied with the regulations, and, except in a few instances, have not only succeeded in preventing the men leaving camp and carrying disease with them, but also in stamping out the disease in the camps. Some of the difficulties were :

1. The primary difficulty, apart from the neglect to have medical men engaged for the camps, has been the neglect of the regulations, both by the men and companies, regarding compulsory vaccination. The companies state that the men refused to comply, and they, rather than lose men when employees were scarce, engaged them contrary to law.

2. That this should have occurred is not to be wondered at ; but that the companies should have, in many instances, allowed the neglect to continue till one man after another had been infected, is the more remarkable, since, as has happened in several camps, the disease was allowed to burn itself out, over 40 cases in one or two camps having occurred.

3. To the natural dislike of some of the men to vaccination was added the belief that either they would escape, and not lose even a day or two by vaccination, and that if they had it, they probably would not take it badly.

4. Early in March the circular herewith shown was sent to owners, managers, physicians, and many municipalities, and, judging by results, has had a very remarkable effect, since scarcely an instance has yet occurred of men leaving camps which had been infected and carrying the disease out with them, although it would be too much to expect that some outbreaks will not follow their return home.

5. In view,however, of the many miles' distance of some of the camps from the nearest practitioner, and the practical impossibility of his doing justice in some cases to the men in a camp, who are required to pay 50 cents to $1 per month per man, it will demand some arrangement by which 5th year medical men be allowed to practice under some regular practitioner, as is done in most railway construction camps, if the complaints of the men in some cases are to be removed.

6. How thorough the work of supervision in the camps in the Sudbury district has been is seen in the fact that only some six cases have drifted on to the railway and been corralled in the tent hospital ; while two of these have been Americans who have escaped undetected the quarantine officers at the "Soo."

The question naturally arises, whence these have come. Of the many hundreds of cases recorded during the past winter, I have endeavored to obtain the sources of the first cases in the different outbreaks, but have not yet succeeded in locating it in some instances. The sources have been fairly equally divided between direct importations by persons returning home from or visiting in Michigan, Minnesota, or Dakota, and returning harvesters from Manitoba. As there does not appear to have been any notable prevalence of the disease in Manitoba, so far as it can be learned, it seems most probable, and, indeed, in some cases certain, that returning harvesters were infected on the trains en route between Manitoba and Chicago. Very few are known to have been exposed en route by the C.P.R.

A reference to the table is of interest, as indicating some of the outbreaks ; but those of Stephen, Hay, and Usborne, in South Huron ; of East and West Wawanosh, in North Huron ; of Bruce, Kincardine, and Greenock Townships, in Bruce County ; of the Ekfrid, Lobo, and other cases in Middlesex ; of the Dover, Chatham, Raleigh, Harwich, and Tilbury cases, in Kent, and of Puslinch, Flamboro', etc., in Wellington, may all be cited as outbreaks, due directly to the persons so returning through or from the United States; and which, as seen in the table of cases, resulted in some instances in very widespread outbreaks, due to neglect to early diagnose the disease by physicians, or in some cases to even call in a physician when the first case was mild.

The history of a single outbreak in Puslinch, Wellington, is sufficiently illustrative to be worth citing.

At the eastern end of the Province, the cases have grouped themselves about Ottawa, as an early centre, in the Ottawa district, but other sources, especially from the Quebec side, below Ottawa, have not been infrequent. Several outbreaks, too, have been traced into the St. Lawrence counties, from New York State, in returning shantymen, as in Cornwall, Charlottenburg, Lancaster, etc. The central part of the Province, in the territory radiating from Toronto, has been very largely free of the disease; and from this, doubtless, has arisen much of the immunity of a large urban centre. The disease has this season been essentially one of the rural districts, excepting Ottawa and Chatham, and has scarcely at all appeared in the commercial classes, the travelling portions of which seem to be very particular in view of the constant exposure, to keep well vaccinated.

In view of much that has been learned of the unvaccinated character of the greater part of our communities where smallpox has occurred during the past 15 months, and of the almost universal neglect to carry out the routine requirements of the Vaccination Act by municipalities, the situation imperatively demands that the Act be recast and simplified, with a view to insuring that all children be vaccinated, or at any rate that it be offered them within the first year; that a list of such be recorded, and that later, should they present themselves for entrance into the public schools, that evidence of successful vaccination shall be a *sine-qua-non* to admission to the advantages of schools maintained by Government grants. The present methods of compulsory vaccination, wherever the disease is present, are admirably suited to meet the emergency.

Many questions have naturally arisen during these outbreaks as to the legal requirements in the matter of quarantine and isolation, and the maintenance of persons when so isolated. The Public Health Act and Regulations are very explicit on most of these points; but it may not be generally appreciated that the turning of the house of the person affected into a municipal hospital for the time being is directly contrary both to good practice and to the smallpox regulations. Law suits regarding the liability for damages by the municipality have already been instituted, and will probably still more frequently occur if the practice is not stopped.

Every outbreak proves incontestably the invariable wisdom of the practice of at once establishing a temporary hospital, tent or building, to receive not alone patients, but suspects separately, where they can be maintained at their own cost, with the invariable results that such means, and such alone, are likely to promptly stamp out the disease.

The disease again seems to be on the decline, and it is hoped that the coming month may see its practical disappearance for the season from the Province.

All of which is respectfully submitted.

P. H. BRYCE.

II. QUARTERLY REPORT OF THE SECRETARY.

September 10th, 1902.

To the Chairman and Members of the Provincial Board of Health :

Gentlemen : Your Secretary takes pleasure, in reporting upon the sanitary condition of the Province during the past quarter, to state that an unusual freedom from the diseases incident to the summer months has existed, owing, doubtless, to the cool weather and abundant rainfall. The comparative deaths are seen in the attached Bulletins for June and July.

The outbreaks of Smallpox reported at the last meeting of the Board to be declining may be said for the moment to be practically stamped out. During the months of June, July and August cases have existed in the following centres :

Table of Smallpox.

	Total municipalities.	Total cases.
June	29	211
July	18	46
August	9	39

The dangers of a reappearance of the disease in the northern lumber camps cannot be overlooked; but such far-reaching steps have been taken to prevent this that it is hoped and expected that few cases will appear this season.

Early in July the lumbermen of the Ottawa district, after conference, signed an agreement upon which none of the signatories would engage for their shanties men not vaccinated. They invited your secretary and the officer of the Quebec Board to meet them at Ottawa, and as a result the Quebec Board undertook to secure the action which had already been taken by your Secretary in sending out copies of the following poster and circulars to all lumbermen, and to all parts where men were engaged for their camps.

NOTICE TO EMPLOYERS OF LABOR AND EMPLOYEES

IN THE

UNORGANIZED DISTRICTS OF THE PROVINCE OF ONTARIO.

Shantymen, Miners and other Employees of Lumbering Camps, Mining Camps, Sawmills, Smelting Works and any other Industry, or any Railway Construction Camp, are hereby notified and cautioned by *The Provincial Board of Health* under the "Act respecting the Sanitary Regulations in Unorganized Territories," Chap. 34, 1 Edward VII., that it is required :—

I. That all owners, managers, agents or foremen, or other person in charge of any lumbering camp, mining camp, or other industry, employ only vaccinated persons, and that all employees are equally required to comply with the Regulations.

II. That all employers of labor shall contract with a medical practitioner for their employees and works, and are authorized to deduct from the pay due any employee a sum not less than 50 cents and not exceeding $1.00 per month.

III. That an hospital for the care of the sick must be provided by every employer, and that the men are entitled not only to regular treatment therein, but also to have the camps and surroundings inspected regularly and maintained in good sanitary condition.

IV. That failure on the part of any person to comply with any Regulation of the Provincial Board of Health renders him liable to the penalties provided in the Act.

Signed,

P. H. BRYCE, M.D.,

Toronto, June 30th, 1902. Secretary, Provincial Board of Health.

Extracts from the Regulations for the Sanitary Control of Unorganized Districts.

Reg. 1.—The owner, manager, agent or foreman of any lumbering camp, mining camp, sawmill, smelting works or other industry, or of any railway construction camp located in any district without municipal organization shall, in connection with every such industry or works, be responsible for the proper execution and enforcement of any regulation herein contained, or of any clause of any Health Act governing in any case or circumstance.

Reg. 4.—In connection with every camp, works or dwellings coming under these Regulations, there shall be constructed a building, or, in lieu thereof, a double-walled tent shall be kept on hand with floor or floors and with facilities for heating and ventilation, equal to those provided in the example herein described, for the reception of any employees who may become sick ; and should any disease of a contagious nature, as defined by the Public Health Act, break out, the hospital building or tent must be located by the physician in charge of the patient, in a position satisfactory to any health officer authorized to inspect the camp or works.

Reg. 5.—Every camp or the works of any industry coming under these Regulations shall be equipped with a separate building to be used as a washouse or laundry, and attached thereto a room, or, if preferred, a separate building or tent, equipped with a stove and tubs for bath purposes, in a manner satisfactory to any health officer authorized to inspect the camps or works.

Reg. 6.—Every camp or works coming under these Regulations shall be supplied with a building or tent properly constructed and set apart as a kitchen or cook-house, and having a dining-room or eating-room in connection therewith, with proper conveniences for the cleanliness and comfort of employees, and must be satisfactory to the health officer authorized to inspect the camp or works.

Reg. 12.—Employers of labor on works in the districts without municipal organization shall contract with one or more qualified medical practitioners for the medical and sanitary supervision of their employees and works ; and are hereby authorized to deduct from the pay due any employee, a sum not less than 50 cents and not to exceed one dollar ($1.00) per month, which shall be paid the physician ; and he shall inspect the camps, dwellings or works at least once a month, and oftener if on the decision of the authorized health officer the health conditions of any camp or works or dwelling require it, and shall supply medical attendance and medicine to the employees.

Reg. 13.—The owner, manager, agent or foreman, or other person in charge of any lumbering camp, mining camp, or other industry on which men are employed, shall require a certificate of recent successful vaccination of each employee when he is engaged by the company or its agent ; and where evidence is not forthcoming, it shall be their duty, before employing any person, to obtain evidence of such vaccination.

Reg. 14.—Should any suspected communicable disease as defined under the Public Health Act break out in any camp, works or dwelling, the employer or his employee or agent in charge of any camp, works or dwelling, shall immediately send notice to the physician employed, who shall at once notify the Provincial Board of Health, or some officer thereof, of the outbreak. The employer or his employee or agent in charge of any camp, works or dwelling shall, equally with the physician employed, be responsible for any neglect to notify the Provincial Health authorities.

Reg. 16.—Every measure required to be taken by a Local Board of Health or any medical health officer, sanitary inspector or other health officer under the Public Health Act, or any Regulation made thereunder in any organized municipality, must at once be taken by the employer and his employees or agents, or the physician employed by the same, whenever any suspected communicable disease included therein breaks out in any camp. works or dwelling to which these Regulations apply. Any neglect on the part of any employer, manager, foreman or agent or the physician employed, shall be punishable in the manner provided by the Public Health Act.

As many companies are already at work in the woods, the absence of reports of any outbreaks leads to the belief that the action taken has had very happy results. The ready co-operation in the Ottawa district has made it all the easier for your officers to urge the enforcement of similar methods in the western areas of the Province. So far as known, those of the great areas between North Bay and the Sault, in the Georgian Bay district, are complying in every way with the spirit of the Act, and Dr. Hodgetts, who has recently spent some time in the district, is much satisfied with the action taken. The steady improvement of the sanitary conditions of the camps goes on, and new camps are being built according to the rules of the Board.

Scarlatina. The necessity for special regulations regarding scarlatina would seem to be called for by the appearance at several points of outbreaks of more than the usual virulence. Especially is this true regarding an outbreak in Lindsay in June and July, resulting in 11 deaths. Strong measures have eventually stamped out the disease.

Typhoid fever has appeared in a few sections, but only in isolated instances. The climatic causes, already mentioned, may be credited with this immunity. Especially is this freedom to be noted in those temporary aggregations of people at summer resorts. The steady progress of education in methods of sewage disposal goes on, and not a few installations of the septic tank, with sub-surface tiles, in hotels and private residences has gone on, and are proving very successful. The work of installing new systems of waterworks and sewerage systems goes on throughout the Province, and laboratory analysis of a number of proposed town supplies have been made, and the formal plans will, in a number of towns, shortly be submitted for approval.

Reports of the special and standing committees will be presented.

All of which is respectfully submitted.

P. H. BRYCE,
Secretary.

III. QUARTERLY REPORT OF THE SECRETARY.

November 26, 1902.

Mr. Chairman and Gentlemen : The public health of Ontario has continued to be good since the last quarterly report of the Board. The prevalence of no disease has been high or unusual. The cold, wet summer has been favorable to a low prevalence of typhoid, as may be seen from the tables of the Monthly Bulletin ; but there have been several limited outbreaks of a severe type, showing the existence of conditions relative to well-pollution, indicative of a great lack still of popular knowledge as to the causes which bring about outbreaks of well typhoid.

The special reports on Sault Ste. Marie, Burk's Falls, Niagara Falls, and Tyrone are all illustrative of the fact that a very notable proportion of the public are ignorant and careless as to the nature and character of the filth which surrounds them in its relations to health, and that Local Boards of Health seem, as at present constituted, strangely ignorant or indifferent as regards the enforcement of laws which lie at the very beginning of good municipal health work. As remarked before, the council which appoints too often either its own members or persons who are incapable of independent and intelligent action, seems in the majority of instances to be incapable of appreciating the economic value of good health measures, and hesitates to exercise in any thorough way those powers for preventing nuisances, and remedying defective structures, as well as privies, etc., which are the alpha and omega of routine public health work.

The ridiculous sums set apart for public health work, as seen in the annual returns, fully illustrate the need for some notable change in the methods ; and, as your Secretary has frequently observed, (1) the enlarging of the municipal health unit, (2) permanency of tenure of officers, (3) and adequate compensation for trained officers, such as is provided by the recent legislation of England, are a *sine qua non* to progressive and efficient public health work; whether in Ontario or elsewhere.

Smallpox. The table herewith submitted shows how satisfactory the situation as regards smallpox has been during the quarter :

It is apparent, however, from the last fortnight's reports, that we are to again see during the coming winter a recrudescence of smallpox, which it is to be feared will be of an old-time type as regards severity. In Cleveland during the past five months some 1,079 cases and 186 deaths have occurred up to November 8th, and within a few weeks 20 cases of hemorrhagic type had each proved fatal. Detroit has 50 or more cases in hospital, and others, it is believed, are being hidden. Most of the cases there have been mild. At last report 12 families and 20 cases are in quarantine at Port Huron, while the present week reports a recrudescence at Rochester of what previously proved a virulent type of smallpox—50 cases being reported to be there. Several centres have in the meantime devloped in Ontario, one or two the outcome of cases of last spring, as in Caradoc in Middlesex, Bayham in Elgin, Torbolton Township in Renfrew, and Waterloo Township, while others have been brought in from the Province of Quebec to Ottawa, to South Plantagenet, and Fitzroy Township. Others have been introduced by way of the United States to Toronto, to Anderdon, to Tecumseh in Essex, St. Catharines, etc. So it is apparent that the disease is prevalent across the Border. Ohio has had since June 2,600 cases and 248 deaths, while from October 11 to November 8 there were 319 cases in 34 deaths in 56 municipalities. Michigan has many cases and a few deaths to November 23, while New York State had at last returns many cases and some deaths. The Board may, therefore, look upon the relative immunity of the Province with much satisfaction, while at the same time exercising all vigilance to maintain the present excellent condition.

The evidence of the past three years has been amply sufficient to show that the Act re vaccination is, so far as regards the appointment annually of public vaccinators by councils or Local Boards of Health, as in the great majority of instances, wholly neglected. The result of this is that year by year there is growing up a population largely unvaccinated, while its aggregation in the cities and towns is with each decade more pronounced. There are to-day some 45 per cent of the population of Ontario in cities, towns, and villages.

Thus the dangers of the spread of smallpox will increase proportionately, and we may expect gradually to develop conditions such as those of the great cities of the United States, which, as Boston, New York, and Philadelphia, were only protected last year against a devastating epidemic by compulsory vaccination of the whole population. Boston used some 500,000 vaccine points, and Philadelphia 1,000,000 last year.

Such facts make it evident that some radical change ought to be made whereby the utter indifference of councils to the statute requiring them to have all children vaccinated within four months of birth may be overcome by some more simple and practical scheme.

It has occurred to your Secretary that if the present Act were repealed and an Act of three or four sections were passed providing that

1. The Clerk supply a specially appointed officer, for instance, the Medical Officer, with the names of all children born during the previous six months; and that such officer be required to visit at their homes these children, and offer free vaccination.

2. Should there be a refusal, the duty would then devolve upon the parent of having the child vaccinated, at his expense, before it could be

admitted into any school, public or private; and the vaccination officer would be further required to visit every school and vaccinate all not already vaccinated.

3. A third clause containing the provisions of the present clause 8 of the Smallpox Regulations providing for compulsory vaccination whenever a case of smallpox exists in a municipality, would constitute practically the whole Act. There would be, in addition, a single clause providing for regulations being passed arranging the details for carrying out the work of vaccination, and supplying the Provincial Board of Health with certified lists of all children or persons vaccinated during any year.

It will be apparent that by such a method the work would be systematized, while the at times not unreasonable objections to the present absence of system in performing the important compulsory operation would be removed.

By it vaccine could be used at all times when fresh, and the children vaccinated would be supervised by a single officer, who not only would be responsible for his own work, but as a public official would be in a position to obtain and supply information regarding the quality of the lymph used.

Diphtheria: The prevalence of this disease has been small this autumn, due in part to the favorable season, and further to the constant care which is now exercised in case the disease appears. Antitoxin becomes more and more a routine measure of value both in treating the disease and in prophylaxis.

Scarlatina : While nowhere prevalent, has appeared with fatal results in a few instances.

Anthrax: The appearance of anthrax in several new centres in the Province, in cattle has become a subject of remark; and it is to be regretted that some more systematic means than is being carried out at present is not adopted for investigating the source of first cases.

The seeding of pastures from the overflow of infected streams seems to have been the cause of most first outbreaks; but whence have come several other outbreaks is not so apparent.

The problem is an important one, and in relation to the economic side of public health work, has a high importance.

A number of nuisances, such as knackeries, and slaughter houses, and cattle yards, have called for attention during the quarter, and have been variously dealt with, as will appear in the correspondence.

All of which is respectfully submitted.

P. H. BRYCE,
Secretary.

IV. QUARTERLY REPORT OF THE SECRETARY.

Feb. 11th, 1903.

To the Chairman and Members of the Provincial Board of Health :

Gentlemen : I beg herewith to submit the principal points of interest relating to the work of the Board during the past quarter, as relate to outbreaks of diseases. Since the Board met last on November 27th, the public health has remained fairly good, with two exceptions, viz., the prevalence of smallpox and of scarlatina, both of virulent form, which we, fortunately, for some time hitherto have been free from.

The following synopsis of smallpox, prepared by Dr. Hodgetts, Medical Inspector of the Board, sets forth the situation as regards smallpox. In December the Province, compared with the previous year, showed a smaller number of cases and outbreaks.

Dr. Hodgetts' report of January shows that the same may be said; but, nevertheless, the number of outbreaks, and especially their character, have given your officers cause for anxiety, especially since the outbreak at Galt, having obtained headway, and having been the source of the disease in several other municipalities, the extent to which the disease might extend was for a time in doubt. How extended have been the exposures has been apparent from the statistics just presented.

The activity of the Local Board and its medical officer in Galt, since the character of the outbreak was realized, has been very satisfactory. There was some delay in getting the isolation hospital complete; but the town has now a permanent and very complete isolation building, which has enabled the Local Board to have all cases removed, and the quarantine raised on the houses in the town.

More than 5,000 people had been vaccinated in a town of 8,000 during January, and the Local Board are continuing to push the compulsory work with vigor.

The virulence in the type of disease throughout the Province, as your officers have reported from time to time, has been assuming a character not seen since 1900 in the cases from the Orient. Five deaths have occurred in Galt within a fortnight, two in Preston, one in Toronto, and two on St. Joseph's Island, in Jocelyn Township, while the character of those in many of the other outbreaks is of almost normal virulence.

The generally unvaccinated character of the younger population of the Province is, unfortunately, too well exemplified in the history of the several outbreaks set forth in the report of Dr. Hodgetts, just presented, and found printed later as a separate report.

The delicate and scientific discrimination of the *contagium vivum* of variola in selecting its victims from the innocent sufferers of parents' neglect—it cannot in the light of a century be called ignorance—to have their children vaccinated, affords much food for thought on the part of persons who may have doubted the efficiency of vaccination in protecting against smallpox.

The continued presence, and at times prevalence, of smallpox in the Province for four consecutive years must afford every citizen serious cause for consideration as to how long the expenditures which it entails, quite apart from the loss of health and danger to life of the patient, the serious family loss through the quarantine of thousands of persons for several weeks, the cost of disinfection, the charges for nursing and physicians, and, more than this, the cost to the municipality for physicians, Medical Health Officers and police, are to continue. It will be remembered that it was estimated on the basis of returns made at the end of 1901 from a large percentage of municipalities that some $450,000 had been expended in that year to suppress smallpox, wholly apart from the loss to individuals or the expenditures by the Government. This was probably equalled in 1902, if we take the total cases as a guide in 1902, the total cases reported having been 2,486.

In the face of such facts it is a remarkable commentary on the inertia of municipal authorities, that, although since 1863 there has been on the Statutes a Vaccination Act, requiring that the municipal councils year by year provide for the vaccination of all children born during the year, so far as your Secretary is aware there is not in the Province a single instance at the date of writing where a municipality has at the beginning of the year appointed a public vaccinator and stations as referred to by the Act for the vaccination of the young children; and there is no instance where any attempt has been made to determine by a statistical report how many infants born in any municipality during the past year have been vaccinated.

We have instances, it is true, as where Ottawa, in view of the great commercial loss the city was sustaining, went systematically to work within the autumn of 1901 and vaccinated some 20,000, and promptly stayed the spread of the epidemic; when suddenly some politic alderman moved that the epidemic of vaccination be stayed, and it was stayed forthwith; and we have had Galt boycotted by neighboring towns, with losses to trade mounting up to many thousands of dollars, pressing the compulsory clauses of the Smallpox Regulations, and vaccinating practically the whole population.

We have seen Deseronto, in 1901, when a single case of smallpox appeared, having the whole population vaccinated within a fortnight in the interests of business, and this practically prevented the possibility of other cases, as with numerous exposures from the Indian Reserve recently, but one case is reported as occurring in the town; and we further have had the township of South Plantagenet, with numerous cases of smallpox, where the municipal council was neglecting the disease, instructed in the end of November, that if they did not at once appoint a Medical Health Officer with compulsory powers to vaccinate during an epidemic, to vaccinate generally, the Provincial Board of Health would be forced to do it at the township's expense.

These are illustrations of what, except in the case of Deseronto, has been done after smallpox has become prevalent; but, excepting Toronto, Windsor, Walkerville, Sarnia, and perhaps a few other cities, where children must present a certificate of vaccination before they are admitted to the public and separate schools, the very knowledge of the existence of a Public Vaccination Act seems to be unknown, as regards its provisions, by the councillors and Boards of Health of most of our municipalities. It is quite apparent from the illustrations given that the belief and opinion of the great body of the public is behind the medical profession in its attitude as to vaccination; but it is equally plain that the years of freedom, since the great epidemic in Montreal in 1885, when public fear made vaccination general, up to 1899, when the mild epidemic appeared, have allowed in this matter public attention, and with it municipal action, to drift entirely away from their duties under the Vaccination Act. The tendency is a natural one, perhaps; but, as the facts of the past three years show, no closing of our eyes will remove the dangers, while any country where commerce and travel, with the increase of urban populations, are making such strides, must increasingly be exposed to smallpox, if it allows its young population to grow up unvaccinated.

It would seem apparent, therefore, that however adequate the provisions of the Vaccination Act, which has existed for 40 years, were, when passed, they are not of such a character as to harmonize with the organization of public health work as it has existed for twenty years under the Public Health Act. Under these circumstances it seems desirable that the Act be recast so that its machinery may readily and systematically be put in operation, so that the children born in any year, and those of school age, may be vaccinated by competent medical officers appointed as public vaccinators, acting under clearly defined instructions, whereby at the least inconvenience to the parents, a well-vaccinated community may grow up protected against the inevitable introduction of smallpox along an ever increasing number of avenues, which by the position of the Province, as the great pathway of commerce, from the east to the west and northwest, it must more and more continue to develop.

It is hoped that a short Bill, which at a later session will be presented by the Committee on Legislation, will fulfil the requirements indicated.

Scarlatina. The reports from different parts of the Province show that during the past six months this disease has appeared in a number of centres with a virulence which has not for many years been equalled in this Province. For instance :

In 1902.	Cases.	Deaths.
Toronto had	701	88
Ottawa	689	50
Blenheim	4	1
Windsor	30	3
Clinton	10	10
Peterborough	100	15
Mulmur	3	3
Lindsay	31	10
Durham	0	4
Alfred Township	75	6
Puslinch	4	4
Fort William	70	13
Hintonburg	87	7
Erin	2	5

Other places return a number of cases, but with a mortality similar to that of past years. Thus :

	Cases.	Deaths.
Hamilton had	97	3
Berlin	21	1
Brockville	30	0
Dresden	7	1
Galt	5	0
Schreiber	24	3

From these illustrations it appears that in the death rate in the 12 cities, which have made returns the rate was 9 per cent., while in Toronto it was 12.5 per cent., and in Ottawa 7.4 per cent. The malignity of type is illustrated by there having been 21 deaths in 106 cases in Toronto in January, 1903, and 13 in Peterboro', in December in 21 cases. In some of the other places which have made returns it would appear that all the cases have died ; but doubtless this must be explained by the fact that the cases occurring have not been returned.

The increase in virulence is well illustrated by comparing the figures in Toronto with those in the epidemic of 1897, when during the first six months, with the total cases 1,138, there were but 63 deaths, or a rate of 5.5 per cent.

These figures are illustrative of the fact that scarlatina is a disease more remarkable for variation in type than probably any other of the infectious diseases which prevail in temperate climates.

Sydenham, in the 17th century, writing of scarlatina, spoke of it as hardly deserving the name of a disease ; but in the quinquennium, 1861-65, it caused a mortality of 1.11 per 1,000 in London, England.

The frightful mortality caused by scarlet fever in England may be judged from the following statement of deaths from the Registrar-General's Report for 1874:

1855	17,314	1866	11,685
1856	14,160	1867	12,300
1857	14,229	1868	21,912
1858	30,317	1869	27,641
1859	19,407	1870	32,543
1860	9,681		Also 24,000 of smallpox
1861	9,077	1871	18,567
1862	14,834	1872	11,922
1863	30,475	1873	13,144
1864	29 700	1874	24,922
1865	17,700		

The same virulent type apparently prevailed in Ontario at the same time, for the imperfect statistics of the time give the following results:

1871	630 deaths	1882	543 deaths
1872	642 deaths	1883	405 deaths
1877	717 deaths	1884	382 deaths

How the disease has on the whole declined in its fatal character during these years is indicated in the table of deaths by years, although a part of the lowered death rate must be attributed to better isolation and disinfection.

The broad historical fact, however, exists that it is a disease of remarkable character. Dr. Caiger, in Albutt's System of Medicine, says: "All the records of scarlatinal epidemics in the past go to prove that the fatality of the disease in different outbreaks has been subject to enormous variation"; and this opinion is confirmed, up to a certain point, by our own experience at the present day.

This variation in fatality is marked, not only in epidemics widely separated both in time and locality, but also in outbreaks which have been simultaneously prevalent in contiguous localities. The type of the disease may, however, remain constant for many years in a particular locality. Trousseau, too, reports that Bretonneau had never seen a death from scarlet fever in Paris from the year 1799 to 1822; but that in the year 1824, the disease prevailed in a most malignant form in the town and surrounding district. Graves, speaking of the Dublin epidemic in 1802, states that the disease prevailed in a most malignant form, while it was followed with a mild type for 27 years, after which it again became malignant.

We have thus historically illustrated the variations in type of a disease in which the mortality has varied in different outbreaks from 2 to 30 per cent. of cases; and with the type now confronting us in Toronto and other places, it is apparent that the Province is face to face with a situation more serious than anything that has appeared, in so far as the disease is concerned, within the past 20 years. It may be proper to briefly recall some of the features of the disease.

The Cause of Scarlatina. It would appear that quite recent investigations have shown that the germ of the disease belongs to the group allied to streptococci, which are noted for the great variations in type as regards virulence, suddenly increasing, and almost as suddenly falling away in virulence. The persistence of the infection when closed up in clothing, in dust, or in dark spaces, is very remarkable, though the virus seems readily destroyed by disinfectants properly used.

A Disease of Children. While it is essentially a disease of childhood, it must be remembered that many grown persons are immunes because of having had it during childhood. It is, however, especially fatal amongst children.

In the London Metropolitan Asylums, Board Hospitals, with 10,000 cases treated annually, the case mortality was, between 1871-1893:

Under 5 years..............	19,595	18.2 per cent mortality.
5 to 10 years..............	28,763	5.6 per cent. mortality.
10 to 15 years.............	12,444	2.6 per cent. mortality.

The Infectiousness and Period of Incubation of the Disease. The disease is infectious within the first twelve hours of its onset to susceptible young children, and the onset is commonly within 4 days after exposure, but in young children is generally not longer than 2 days, while Dr. Caiger, of the Metropolitan Hospitals, states, after seeing thousands of cases annually : "I have never met with an instance where there was any valid reason to believe that the period has been longer than 6 days."

The disease is contagious for a period varying in different cases ; but Dr. Caiger says : "It is a good rule in practice to regard six weeks from the rash as the minimum length of quarantine ; and the length of time beyond this will be dependent upon the end of peeling, and upon the cessation of any discharges from the ears, nose, eyes, a mucous cavity or wound of any description." An ear discharge may certainly retain infection for a period of six months ; and the desquamation, though usually complete in six or eight weeks, may persist and be contagious for a period of three or four months. The average number of days' residence in hospital of the 14,143 cases treated in the Metropolitan (London) hospitals in 1901 was 59.72 days, including deaths, or 62.48 days of all who recovered. The mortality was only 3.82 per cent. Of course, it is apparent that the complications of scarlet fever will be great in proportion to the severity of the disease ; and as we have at present to deal with a remarkable increase in the virulence of the disease, it becomes necessary that special attention should be drawn to these special causes of infection. What proportion these complications bear to the total cases, even with a mild type of the disease, is set forth statistically in the last London Report. For instance, of otitis, or discharging ears, there were 13.78 per cent.; albumenurea, 7 per cent.; adentitis, or involvement of glands, 7.2 per cent.; nephritis, or kidney disease, 4 per cent.; diphtheria, 2.7 per cent. Let the virulence of disease be increased, so that instead of 4 per cent. of deaths we have 20 per cent., and it is apparent that complications will be greatly increased. Viewed from the standpoints, 1st, of prevention, 2nd, of lessening the mortality, and 3rd, of reducing the various serious secondary effect of the disease, your Board is to face with a problem even more serious than that of dealing with smallpox for the following reasons:

1st. Because of its generally mild character till within the past year.

2nd. Because the strongest argument, that of injury to business, is not so potent in the case of a disease which is peculiarly one of childhood and youth.

3rd. That we have not any known prophylactic means like vaccination at our command.

4th. That the long period of necessary isolation is very irksome to both patients and householders, and there is a proportionate tendency on the part of parents, and sometimes through them of some physicians, to make light of or even secrete, or misname the disease to prevent notification, isolation and placarding.

5th. That while municipalities will readily arrange for a separate building or hospital for smallpox, many are slow to supply the same for scarlet fever and diphtheria, leaving cases to be treated in their homes, with the common result that all the children in the house take the disease, and should the parent be allowed to go to business, there is the not infrequent danger of the disease being carried outside.

6th. The extreme contagiousness of the disease to susceptible children from its onset, and hence the danger of a mild case with sore throat being the cause, directly or indirectly, of its spread through the schools, and especially amongst the younger children.

The following are a few illustrative instances of outbreaks which have been investigated by your officers or reported by Medical Health Officers. Your Committee on Contagious Diseases, therefore, with a view to coping with the disease, has prepared the appended regulations for the approval of the Board, to the end of having them make an Order-in-Council for the guidance of Local Boards of Health in dealing with outbreaks of scarlatina.

All of which is respectfully submitted.

P. H. BRYCE.

REPORT OF THE COMMITTEE OF EPIDEMICS RE COMPULSORY NOTIFICATION OF CASES OF CONSUMPTION.

Toronto, November 26th, 1902.

To the Chairman and Members of the Provincial Board of Health :

Gentlemen : As you are aware, your committee have on several occasions made representations in favor of the compulsory notification of cases of tuberculosis by local physicians to the Medical Health Officer, and these recommendations have also been endorsed by this Board. For instance, the Committee on Epidemics of the Provincial Board of Health of Ontario issued, June 19th, 1900, the following circular containing, among other instructions, a copy of resolutions passed by this Board dealing with the problem of limiting the spread of tuberculosis, and especially of that more prevalent and contagious form of it known as consumption. That circular states:

Moved by Dr. Cassidy, seconded by Dr. Bryce :

1st. That as tuberculosis is a contagious and infectious disease, all inmates of Provincial institutions who are affected with this disease should be isolated in wards set apart for such patients, and not be permitted to associate generally with other inmates.

2nd. That when rooms or wards which have been occupied by consumptive patients become vacant, they should be disinfected according to the methods set forth by the Provincial Board of Health, in the pamphlet issued by it containing rules for checking the spread of contagious disease.

3rd. That an individual affected with tuberculosis and living in a private family should be isolated, as much as possible, from other members of the household, especial care being taken in the destruction of his expectorations.

4th. That when the room occupied by such a patient becomes vacant, it should be thoroughly disinfected, and, as a matter of prevention, the whole dwelling should be disinfected according to the instructions in the pamphlet regarding disinfection issued by the Provincial Board of Health, and that such other precautions be taken as are provided in Section 101 of the Public Health Act (1897).

5th. That the Local Boards of Health be urged to establish rules for the notification of cases of tuberculosis to the Medical Health Officer, or to the Secretary of the Local Board of Health of the municipality.

While your committee are of opinion that the opinions expressed and the advice given on the first four sections of the above resolutions have been of great use in instructing the public as to the communicable nature of tuberculosis, and the necessity of taking proper precautions to prevent its dissemination, we regret that, up to the present time, none of the Local Boards of Health in Ontario, with one exception, have undertaken to establish rules for the notification of cases of tuberculosis to the Medical Health Officer.

The exception referred to is the City of Hamilton. Understanding that the Local Board of Health of that city favored the establishment of a by-law providing for the notification of cases of tuberculosis to the Medical Health Officer, a member of your committee wrote to Dr. Walter F. Langrill, M. H. O., Hamilton, asking for information on this question. His reply is as follows:

Hamilton, Ont., Nov. 5th, 1902.

Dear Dr. Cassidy:

The by-law is not yet in force, but has been endorsed by the Board of Health, and will be submitted to the City Council at its next meeting. I recently read a paper before the Hamilton Medical Society, which includes two-thirds of the practitioners in the city, and they were practically unanimous in favor of compulsory notification. I think the process of enforcement of such a law must be developmental. After registration I would take no action if the physician would agree to instruct the patient in proper methods of disposal of sputum, etc., and distribute the literature supplied by the Board of Health, but, of course, requiring owners of apartments to renovate, and the Board will disinfect after change of address or death. In the report required from physicians this question will be asked, "Do you wish an inspector to visit the premises, and instruct the family regarding prophylaxis; answer Yes or No," the understanding being that if the answer be No that the physician will adopt and supervise the necessary measures himself. In this way the better class of people will not be antagonized, and, moreover, among this class action by sanitary authorities is not so much needed, since they live in large houses and good sanitary conditions prevail. Physicians also take more pains in instructing the families in prophylaxis. Among the poor and so-called laboring classes I expect the physicians will look to the Health Department to take action. In such cases the premises will be inspected, instructions given as to preventive measures to be adopted, and literature left. This inspection will be repeated at regular intervals. After death or removal the apartments will be disinfected and renovation required. I do not anticipate in this city any trouble in the enforcement of the by-law if discrimination be used. The only thing to fear is that physicians will neglect to report, through indifference and carelessness. They will require stirring up from time to time. I expect the same results as in typhoid. Every year I have reminded physicians of their duty in reporting typhoid, and yet, I think, only about 75 per cent. of cases are reported. I must say I have not felt like prosecuting, as in the case of diphtheria, scarlet fever or smallpox. I do not by any means look for complete results from this by-law, but I think much good can be accomplished. If you have any objections to such a by-law, or any suggestion to offer, I wuld be pleased, if not too much trouble, for you to write me. Yours very truly,

WALTER F. LANGRILL,

Medical Health Officer.

In reply to a letter informing Dr. Langrill that the members of the Committee of Epidemics of the Provincial Board of Health of Ontario had already, as per circular quoted above, advocated the notification of cases of tuberculosis to the M. H. O., and, that, therefore, the passage of the contemplated by-law in Hamilton would be agreeable to the Provincial Board of Health, and, furthermore, requesting information as to the probable date of the next meeting of the Hamilton Council, Dr. Langrill sent the following letter:

Hamilton, Ont., November 17th, 1902.

Dr. J. J. Cassidy, 69 Bloor Street East, Toronto, Ont.:

Dear Doctor,—The next meeting of the City Council will be held on the 24th instant. I am not sure the by-law will pass, but do not know of any strong opposition to it. Thanking you for your kind reference to our action in this matter, I am, Yours very truly,

W. F. LANGRILL,

M. H. O.

At its regular meeting, held November 24th, '02, the City Council of Hamilton, among other business transacted, passed By-law No. 226, respecting the Public Health By-law, a copy of which is herewith submitted:

BY-LAW NO. 226.

Respecting the Public Health By-law.

Whereas it is expedient to amend the Public Health By-law so far as the same is in force in this municipality, and By-law No. 46 of this municipality respecting the Public Health, by making further provisions relative to reports of medical practitioners to the Medical Health Officer;

Therefore the Council of the Corporation of the City of Hamilton enacts as follows:

1. Rule 1 of section 29 of By-law No. 46 of the Revised By-laws of this city is amended by adding at the end of said rule the words, "and every medical practitioner practising within this municipality shall report to the Medical Health Officer upon one of such forms, every case of diphtheria, smallpox, scarlet fever, cholera, typhoid fever, measles or other disease dangerous to the public health which he is called upon to visit in the City of Hamilton, such report to be made within twenty-four hours after he knows that his patient has such disease, and shall also report to the Medical Health Officer the death or recovery of his patient from any such disease, within twenty-four hours after such death or recovery.

2. Rule 1 of said section 29 is also amended by adding thereto the following sub clause:

(a) Every medical practitioner practising within this municipality shall report to the Medical Health Officer upon one of the forms provided by him for the purpose every case of pulmonary tuberculosis which he attends or is called upon to visit in the City of Hamilton, such report to be made within one week after he knows that his patient has such disease, and shall also, if the patient dies from such disease, report the death to the Medical Health Officer within twenty-four hours after it takes place.

Passed this 24th day of November, A. D. 1902.

T. BEASLEY,
City Clerk.

JOHN S. HENDRIE,
Mayor.

A copy of Dr. Langrill's letter forwarding the same is herewith submitted:

Hamilton, Ont., November 25, 1902.

P. H. Bryce, Esq., M. D., Secretary Provincial Board of Health, Toronto:

Dear Sir,—Enclosed find copy of by-law respecting compulsory notification of pulmonary tuberculosis.

Yours truly,
W. F. LANGRILL,
Medical Health Officer.

Your Committee desire to express satisfaction at the action taken by the Hamilton Council in this matter, and their warm appreciation of the efforts of the Local Board of Health of Hamilton and the Medical Health Officer, Dr. Langrill, to secure the passage of this by-law. We hope that, stimulated by so good an example, other Local Boards of Health and Medical Health Officers in Ontario will urge on their respective councils a course of action in respect to the notification of tuberculosis similar to that which has just been adopted in Hamilton.

All of which is respectfully submitted.

J. J. CASSIDY,
WM. OLDRIGHT.
P. H. BRYCE.

REPORT OF THE DELEGATE TO THE MEETING OF THE CANADIAN ASSOCIATION FOR THE PREVENTION OF CONSUMPTION AND OTHER FORMS OF TUBERCULOSIS.

September 10, 1902.

To the Members of the Provincial Board of Health:

Gentlemen,—As one of your delegates, appointed at our last quarterly meeting, to attend the annual convention of the Canadian Association for the Prevention of Tuberculosis, held at Ottawa, April 17 and 18, I beg to report as follows:

By the courtesy of Dr. MacCabe, the sessions of the convention were held in the Normal School building, Elgin street. The officers were:—Honorary President, His Excellency the Right Hon. the Earl of Minto, G. C. M. G., Governor-General; President, Sir James A. Grant, M. D., K. C. M. G.; Hon. Secretary, Mr. H. B. Small, M. D.; Hon. Treasurer, Mr. J. M. Courtney, C. M. G..

At the first session, April 17th, at 3 p. m., the address of the President, Sir James A. Grant, was delivered. The President reviewed the researches which had been carried on in connection with tuberculosis, and the general public interest which is being aroused on the question. He said:—"A question before us, and one which will, doubtless, be carefully considered in the ethnology of tuberculosis is, 'Is the tubercle bacillus the chief factor in its production?' It is a known fact that individuals are immuned to certain doses of the tubercle bacillus, and does the present stage of our knowledge warrant us in requiring the absolute isolation of phthisical patients? What we do require is better accommodation for the treatment of the poor, less of the sweating in manufactories, increased vital capacity of air in underground and overground compartments, where operatives are almost huddled together. In addition, the result of excessive strain of brain and general nerve tissue in our present system of education, the food problem, and scrap diet in school or college life, the excessive use of alcohol, and defective sanitary arrangements, all of which, misdirected, have an undoubted tendency to lower the vital powers of the system, and become potent factors towards the development of tuberculosis."

On motion of Hon. Sydney Fisher, Sir James Grant was elected Chairman of the Association for the current meeting.

Committees, four in number, were appointed to consider and report upon the following and other matters:

Committee No. One.

The permanent organization of and constitution for the Canadian Association.

Committee No. Two.

(1) The relation of governments and municipal bodies to the crusade for the prevention of tuberculosis;

(2) Legislation;

(3) Notification by physicians of the presence of the disease;
(4 Inspection of schools and examination of children;
(5) Inspection or warnings against dangerous meat, milk, etc.

Committee No. Three.

(1) The availability of general hospitals, sanatoria, seaside and other resorts;

(2) The care of public conveyances (steamships, railway carriages, street cars, etc.), to prevent the spread of the disease.

Committee No. Four.

The collection and publication of useful information for the education of the people twards securing their co-operation with the medical profession.

Committee No. Five.

Resolutions.

Arrangements were made that these committees should meet in different rooms in the Normal School building, transact their business, and report to the convention on the following day.

At the second session, April 17th, 8 p. m.,

His Excellency the Governor-General of Canada in the chair, a number of the people of Ottawa were present, so that the hall was comfortably filled. His Excellency, who is Honorary President of the Association, addressed the meeting, and was very heartily applauded. He alluded to the fact that the Association was meeting for the first time as an organized body, and hoped that at each succeeding anniversary the President would be able to lay before them not only a greater knowledge of the mysteries of the fell disease they were combating, but increasing proofs from year to year that its ravages were at last giving way before that knowledge of treatment and precautions which we owe to scientific research and discovery. There was no greater leader in that research than Dr. Knopf, who was the guest of the Association, and who, in the midst of all the calls of a busy life, had generously found time to come to Ottawa and lay before them the invaluable conclusions he has drawn from the studies, which have already earned him a world-wide reputation. In conclusion, His Excellency said:—"The history of the disease is full of interest. Dr. Knopf, in his celebrated prize essay, quotes Hippocrates, who lived between 460 and 377 B. C., as well acquainted with its deadly results, and traces its rate of misery through the middle ages to the present day. And since the days of Hippocrates it has never left the people, and is still with us, the most fatal of all diseases—killing the health of the young, and the athletic, and the beautiful. Ladies and gentlemen, an Association must provide the armor with which we may successfully encounter this dread foe."

Dr. S. A. Knopf, of New York, was then introduced by His Excellency, and delivered an address entitled, "The Mission of the Societies for the Prevention of Consumption in the Anti-tuberculosis Crusade." Dr. Knopf is a polished and agreeable speaker, and was heard with great interest. His address was lengthy, and dealt with matters of importance. As it has been published in full by the Association before whom it was delivered, I herewith submit it as part of this report.

A general discussion followed, in which the views expounded by Dr. Knopf were endorsed, and he was cordially thanked for his interesting address

April 18, 10 a. m., the session was allocated to the various committees to discuss and frame reports or resolutions, to be presented at the afternoon and evening sessions of the convention. Your delegate was nominated a member of Committee No. Four, which was appointed to report on the collection and publication of useful information for the education of the people towards securing their co-operation with the medical profession. The chairman of this committee was W. C. Edwards, M. P.; the secretary, Dr. Eby.

At the fourth session, April 18, 2.30 p. m., the various committees reported. The report of each committee was taken up clause by clause, discussed and dealt with. After the reports of the committees had been received, it was decided, on motion, that as the subject matter of some of the reports of committees touched somewhat on that of the reports of the other committees, the Executive Committee of the Association would, prior to publication, be empowered to prune the reports, so as to overcome tautology or reduplication in the matters reported on.

The reports of the committees, as adopted by the Association, are herewith submitted.

The officers elected for 1902-3 are:

Honorary President—His Excellency the Earl of Minto.

Honorary Vice-Presidents—Sir Wilfrid Laurier, Lord Strathcona and the Lieutenant-Governors of the Provinces, the Northwest Territories, and the Yukon.

President—Mr. W. C. Edwards, M. D., Rockland, Ont.

Vice-Presidents—None at present.

Honorary Treasurer—Mr. J. M. Courtney, C. M. G., Deputy Minister of Finance, Ottawa.

Honorary Secretary—Dr. H. Beaumont-Small, Ottawa.

Executive Council—Appointed by His Excellency the Governor-General—Hon. Sydney Fisher, Minister of Agriculture, Ottawa; Hon. Wm. Templeman, Victoria, B. C.; Mr. R. L. Borden, M. P., Halifax, N. S.; Dr. T. G. Roddick, M. P., Montreal; Mr. C. B. Powell, M. P. P., Ottawa; Dr. F. Montizambert, Director of Public Health, Ottawa; Prof. Robertson, Commissioner of Agriculture and Dairying, Ottawa; Dr. R. W. Powell, Ottawa; Mr. Geo. H. Perley, Ottawa. Elected by the Association—Sir Wm. Hingston, M. D., K. C. M. G., Montreal; Sir James A. Grant, M. D., K. C. M. G., Ottawa; Mayor Beck, London, Ont.; Dr. E. P. Lachapelle, President of the Provincial Board of Health, Montreal, P. Q.; Dr. P. H. Bryce, Secretary of the Provincial Board of Health, Toronto, Ont.; Dr. Fagan, Secretary Provincial Board of Health, Victoria, B.C.; Dr. E. J. Barrick, Toronto; Dr. McNeill, Charlottetown, P. E. I.; Dr. A. J. Richer, Montreal; Dr. G. Bell, Winnipeg.

A vote of thanks to the retiring President, Sir Jas. A. Grant, was suitably acknowledged.

A vote of thanks to Dr. McCabe and the Government of Ontario for their courtesy in granting the use of the Normal School building for the purposes of the convention was passed.

It was decided that a report of the proceedings of the convention would be published. Also that Dr. Knopf's address and a memoir, entitled, "Tuberculosis, a Social and Medical Disease," by Arthur J. Richer, M. D., should be published and distributed by the Canadian Association for the Prevention of Tuberculosis.

It was also decided that the head office of the Association should be at Ottawa.

The convention then adjourned.

All of which is respectfully submitted.

J. J. CASSIDY.

REPORT ON THE MEETING OF THE AMERICAN CONGRESS OF TUBERCULOSIS, HELD NEW YORK, JUNE, 1902.

Toronto,: September 11th, 1902.

To the Chairman and Members of the Provincial Board of Health:

Gentlemen,—Your delegate proceeded to New York in time for the opening of the Congress, which took place on Monday morning, with the object of allowing members to leave in time for the meetings of other societies. The sessions lasted for three days, 2nd to 4th June inclusive, and were held at the Hotel Majestic. Addresses of welcome were made by Clark Bell, M. D., and A. W. Bell, M. D., Secretary and President respectively of the Congress, and replies were made by the representatives of States and nationalities.

The discussions ranged themselves, with certain digressions, on three groups. The first embraced the social, municipal and state aspects of tuberculosis, including preventive legislation, and the aid to be expected from the various sources in the cure and prevention of tuberculous diseases. Nearly all were in favor of compulsory notification, the minority urging that this course might prevent some afflicted ones from seeking medical aid. It was pointed out that there would be less panic and disturbance of social and business relations from certain knowledge and care than from an uncertain danger being left to take care of itself. At the same time the necessity of avoiding needless alarm in the public mind, and in the attitude of people towards those affected by tuberculosis, was dwelt upon. The various means for educating the public to act in concert with sanitary authorities were also considered. These are familiar to you, and need not be taken up here.

The second symposium dwelt with the treatment of cases, both individually and collectively, as in sanatoria. Much interest was taken in the Stratton Act for facilitating the establishment of these, as also in the work at present going on in Muskoka and elsewhere. Three States of the Union were reported as having taken the further step of establishing State sanatoria for the treatment of tuberculosis.

On the third day the attention of the Congress was taken up largely with the question of the intercommunicability of bovine and human tuberculosis. Dr. J. J. Kinyoun and others adduced evidence of cases of tuberculosis in children being caused by milk and other animal products. A very important contribution was that of Dr. Salmon, head of the Bureau of Animal Industries at Washington, who, in common with all prominent men who took part in the discussion, thought that the opinions of Prof. Koch, last year, were premature, and not substantiated; and that we ought not to relax anything of our vigilance in regard to animal tuberculosis.

A pleasing episode of this Congress was the passing of a resolution congratulating our King and the British nation upon the conclusion of the Boer war, for which resolution the thanks of the Canadians were briefly returned.

An interesting feature of the meeting was the "Museum" and exhibit of the American Congress of Tuberculosis, containing plates, pathological specimens, models, materia and armamentaria medica. An illustrated catalogue of the museum of some 42 pages is presented herewith.

To a large number of the delegates it was a matter of surprise and regret that many of the foremost practitioners were absent from the meeting of the Congress, and it transpired that some men who were guilty of unprofessional conduct, in advertising and other similar practices, were using and contaminating the Congress to serve their own ends.

A pamphlet by one of these men is submitted with this report. You will find that it contains such phrases as this:—"Still the cry of the medical profession is not only there is no cure, but 'there shall be no cure' (of tuberculosis)." It then proceeds to give a number of testimonials to the skill of the author and the efficacy of his "germicidal treatment" and "outfit and the prices thereof." It is backed up by a coat of arms on the cover, a dove with an olive branch on a scroll, surmounting a black shield, on which are two horns rampant supporting a dagger, pointing upwards towards the dove. At the lowest depth of the shield appears the name of the author, and beneath all the motto, "In fide et a bello fortis." We fear the fides is not bona fides, and you will find the bellum coming in later.

This pamphlet was the basis of a resolution passed by the Congress, to the effect that the author resign his membership, or that his communication be rejected by the Committee on Publications. Against the mover of this resolution, Dr. Paschal, of San Antonio, Texas, an action for libel was instituted, on what grounds it is hard to imagine. The name of the wonderful scientist concerned is omitted from this report, as it is not necessary to give him any greater notoriety, such as he would desire, by being mentioned in our records.

The condition of affairs described here called for a reorganization and rehabilitation, which was effected by the election of the following gentlemen as officers of the Society:

Honorary President—Dr. Henry D. Holton, Brattleboro, Vt.
President—Dr. Daniel Lewis, New York, N. Y.
First Vice-President—Dr. J. A. Egan, Illinois.
Second Vice-President—Dr. Frank Paschal, San Antonio, Texas.
Third Vice-President—Dr. E. J. Barrick, Toronto, Canada.
Fourth Vice-President—Dr. I. A. Watson, Concord, N. H.
Fifth Vice-President—Dr. Romola, Guatemala.
Secretary—Dr. George Brown, Atlanta, Ga.
Treasurer—Dr. P. H. Bryce, Toronto, Canada.

The suggestion to hold a World's Congress of Tuberculosis in St. Louis in 1904 met with approval, and steps are being taken to advertise this fact and secure the aid of medical journals, societies, physicians, and scientists in making this movement a grand success.

Your delegate expressed regret, which he still feels, at the absence from one of the active positions of Clark Bell, LL. D., who has done so much to originate the Association; but it was thought by the movers in the reorganization that a complete change was necessary to restore the professional prestige of the Association.

Dr. Brown, the new Secretary, has written to Dr. Barrick, Dr. Bryce, the writer, and others, asking that we at once put in operation all means possible to make this World's Congress a success in advancing the interests of mankind. It is suggested that the Board should take the matter up with this end in view, by the appointment of a committee, and such other procedure as to you may seem fit.

All which is respectfully submitted.

WM. OLDRIGHT.

REPORT OF THE COMMITTEE ON EPIDEMICS ON HYGIENIC RULES FOR BARBERS AND HAIR-DRESSERS.

To the Chairman and Members of the Provincial Board of Health:

Gentlemen,—In view of the fact that some common contagious diseases, as well as certain diseases of the skin and scalp, are sometimes propagated by the instruments and hands of barbers and hair-dressers, and that the well-recognized laws of hygiene should extend to the barber business, your Committee on Epidemics, having considered the matter, desires to report as follows:

In providing for the introduction of modern hygienic rules into the barber business, two principal methods may be advised.

The first would be by legal enactment (Provincial), obliging all the master barbers in Ontario to pass an examination before a properly qualified Board, to obtain a license, and to subscribe to the hygienic regulations published or to be published by this Board, which relate to the business of barbering. A flagrant violation of these regulations would entail a revocation of license. Provincial inspectors would probably be required to see to the enforcement of these regulations.

A second method would be:—To have no formal legal enactment put in force in this Province, but for this Board to issue, from time to time, circulars addressed to the barbers, showing them what is expected of them in the matter of hygiene, and also informing them of the most sanitary methods of carrying on the barbers' trade.

In reference to the first mentioned method, it may be said that Michigan has, perhaps, the best legislation on this subject, and it has been found productive of much good. In that State barbers must be examined before a board of experts, and receive a license before they can ply their trade. The applicant must answer such questions as "What kind of a lather brush do you use?" "What do you use for washing lather from your customer's face?" "How do you apply powder to his face?" etc.

Barbers are also required to explain how they keep their razors, how they clean shears, combs and brushes, how they stop the flow of blood from cuts, and what are good sample remedies for eruptions and skin diseases caused by close shaving. The Michigan law requires, also, that a barber shall be a citizen of the United States. He must tell how long he has been a barber, and how he acquired his training; whether under a regular ba[illegible] or "just picked it up."

A State Barbers' Association is in operation in Delaware. It requires all barbers doing business in that State to register. All barbers who have not been in the business for two years are obliged, if desirous of working at the trade, to pass an examination, and, if they pass, certificates are given. Those who fail to pass have to rank as apprentices until they are able to qualify.

Boston, Mass., has issued a short set of regulations for barber shops, applying to that city. It has been adopted by the Boston City Health Department, and places the barbers of that city under the control of the Civic Health Department in matters of hygiene. They quote:

Regulation for Barber Shops.

The place of business, with all the furniture, shall be kept, at all times, in a cleanly condition. Mugs, shaving brushes, and razors shall be sterilized by immersion in boiling water, after every separate use thereof.

A separate, clean towel shall be used for each person. Alum or other material used to stop the flow of blood shall be so used only in powdered form, and applied on a towel. The use of powder puffs is prohibited.

The use of sponges is prohibited.

Every barber shop shall be provided with running hot and cold water.

No person shall be allowed to use any barber shop as a dormitory.

Every barber shall cleanse his hands thoroughly immediately after serving each customer.

Attest, C. E. DAVIS, Jr.,
Secretary.

Writing of the effect produced by these regulations in Boston. Dr. S. H. Durgin, Chairman of the Health Department, Boston, says: "We have gained great headway by these regulations, which have already closed up a large percentage of the shops."

In other States, viz., Indiana, Pennsylvania, California, no special laws have been passed, regulating the hygiene of the barbers' trade ; but circulars have been issued by the Boards of Health of these States giving sanitary advice to barbers and hair-dressers, and calling the attention of the public to the conditions in the exercise of the barbers' trade, which are liable to produce disease.

The Provincial Board of Health of the Province of Quebec has issued a circular containing a set of regulations for barbers, which has been imitated by the State Board of Health of Indiana, and possibly by others. It has been favorably noticed, recently, in La Presse Medicale, Paris.

Having read the circular published by the Provincial Board of Health of Quebec, your committee desires to express its approval of the same, and will avail itself of these precepts in framing its own system of rules.

Regulations for Barbers.

1. A barber should be clean and neat in his person and dress ; should use the bath regularly, and be particular in maintaining a healthful condition of the mouth and hands.

2. No person suffering from any disease of the skin, scalp, or hair should act as a barber ; nor should anyone suffering from consumption or any disease commonly known as contagious serve in this capacity.

3. If diphtheria, scarlet fever, smallpox, measles, or any other contagious disease should occur in the family of a barber, or among his friends or acquaintances, he should not nurse or visit the patients, nor in any way come in contact with them ; and if the disease should appear in his own dwelling or boarding-house, he should temporarily change his residence.

Persons suffering from any disease of the skin, scalp, or hair, or from consumption, or convalescent, that is, persons who have recently recovered, from smallpox, scarlet fever, diphtheria, or other contagious disease, should not visit any barber shop or parlor, but should be attended by the barber at their own homes. All instruments used on such patients should be carefully disinfected after such use.

5. The floor of a barber shop should be made of hardwood, or, if not so made, should be covered with sound oilcloth or other impermeable floor covering. The floor of the shop should be washed frequently with hot water and soap. As a matter of ordinary routine, it should be mopped every morning with a damp woollen cloth. Sweeping is not recommended. If the floor is to be swept, it should first be sprinkled with dampened sawdust or wet tea leaves, and then swept, in order that as little dust as possible may be raised.

6. The shop or parlor should be well aired before the day's work is begun, and it should also be ventilated during the day. It must never be used as a dormitory.

7. Every barber shop should be provided, if possible, with running hot and cold water.

8. The shop should be kept very clean, as should also all of the chairs, razors, clippers, brushes, towels, and all other articles or instruments used in the business. Towels should be carefully washed, and then rinsed to remove the odor of soap.

9. Customers should be encouraged to use, or have used on them, their own instruments (razors, soaps, brushes, etc.), and in the case of persons suf-

fering from diseases of the skin, scalp or hair. this practice should be compulsory. For operations on a dead body, the barber should have instruments used only for that purpose.

Disinfection of Instruments.

Razors and clippers may be disinfected by boiling for five or ten minutes in soapy water, or in water containing a little bicarbonate of sodium or carbonate of potassium. For this purpose they should be laid in an enamelled or galvanized metal dish, completely covered by the water. After boiling they may be cooled in cold water and duly dried.

Steel instruments boiled in solutions of the kinds mentioned above are not liable to rust.

Hair brushes, combs and strops may be disinfected by placing them in a small closet or case, which closes hermetically (is air-tight), in which is kept a saucer constantly filled with a solution of formalin, about one ounce to each cubic foot of space. It is recommended that all instruments be laid on racks or trays in this closet after using. If this is done every customer can have thoroughly disinfected instruments for use in his case. Brushes and combs will need cleaning with bran or clay in hot water at intervals. Shaving brushes may be entirely dispensed with, and a puff of cotton used, which can be destroyed after one using. A shaving brush may be disinfected by being placed in boiling water for five minutes before using. Before passing from one customer to another, the barber or hair-dresser should thoroughly wash his hands. He should use warm water with carbolic soap, or one containing mercuric chloride. The powder puff should be replaced by a powder blower, or by a ball of wadding. The wadding should be thrown away after one using.

A stick of alum should never be used to stop the flow of blood. A small piece of alum after being used on a customer should be thrown away. Some prefer burnt alum, applied on cotton, which can be thrown away after one using.

Sponges should never be used in a barber's work, because they cannot be cleansed as a towel may be. In place of sponges, towels or balls of absorbent cotton should be used.

Toilet wax should not be used indiscriminately ; each person should have his own wax.

The hair-dresser should remove vaseline from the vessel containing it with a spatula or spoon, and not by inserting his possibly contaminated fingers into the vessel.

Only strictly clean linen towels, wrappers, etc., should be used for each customer. If a fresh laundried wrapper cannot be supplied to each customer, a clean towel should be used in place of the wrapper.

Your Committee does not wish to express a positive opinion as to the respective merits of a Provincial or municipal legal enactment, obliging barbers to qualify by examination and obtain a license to carry on their trade, or, on the other hand, a circular requesting barbers and hair-dressers to conform as much as possible to such rules and regulations as this Board may see fit to adopt and publish. In favor of the former plan it may be said, that while some barbers are of themselves disposed to do what is required, others are careless in their methods, and their business would appear to demand careful supervision. A system of licenses, based on a Provincial law, with the probability of the revocation of a license for infraction of the regulations established by this Board would certainly tend to promote the observance of these regulations.

On the other hand, it would be quite satisfactory if the barbers of Ontario were to form a Provincial Association among themselves, similar to the association of that name which has been established in the Province of Quebec. Such an association once established could easily be placed in touch with this Board, and be induced to adopt such hygienic regulations as this Board would think proper to prescribe. As the initial step would then be made by the barbers themselves, it would probably be more successful in securing the adoption of hygienic measures by the barbers, than the passing of a law regulating the barber business made at the request of this Board.

All of which is respectfully submitted.

J. J. CASSIDY.
P. H. BRYCE.
W. H. OLDRIGHT.

REPORT OF INVESTIGATIONS INTO OUTBREAKS OF DISEASE.

By C. A. Hodgetts, M.D., Medical Inspector Provincial Board of Health.

Toronto, Feb. 11th, 1903.

Gentlemen: During the quarter ending December 31st, 1902, I have investigated two outbreaks of enteric fever, viz., those at Niagara Falls and at Enniskillen, a village in the Township of Cartwright; an outbreak of scarlet fever in the Town of Peterboro'; an outbreak of impetigo and scabies in the Albert College, Belleville, besides visiting 22 municipalities for either purposes of diagnosing smallpox or assisting the Local Boards of Health to put in operation the provisions of the Health Act in so far as it relates to this disease.

As scarlet of a severe type is now prevalent, I might refer to the difficulties experienced in the Town of Peterboro', where the disease evidently began with very mild cases. Even the medical men were in doubt, for on August 6th, 1902, a death was registered of a child, aged 10 years, the cause being given as "supposed scarlet fever."

It was not, however, until December 6th, three months later, that the first death was reported as being due to scarlet fever, and in rapid succession 14 others were reported—one child, aged 5 1-2 years, being ill only 36 hours. With public funerals being permitted, it can well be understood how the disease spread; additional dangers were laxity in quarantine, and the permitting of cases to remain in their own houses, instead of an early removal to a hospital, with efficient disinfection of the premises by the local authorities, instead of leaving it to the medical attendant.

In regard to the outbreak of impetigo and scabies at Albert College, it was found that the diseases had been brought to the institution by two of the male pupils, and spread to both resident and day scholars, chiefly, I believe, by the use of a common towel in the lavatory. The affected pupils were sent to the hospital, the school closed, and every effort taken by the authorities of the college to place the institution in a sanitary condition.

The cases of enteric fever reported at Niagara Falls were found to have occurred in persons working on the American side, all of whom used the water of the American town; and further, it was found that there had been a large number of cases of the disease on that side of the Boundary, owing chiefly, I believe, to the impure water supplied to the town by both systems of waterworks. I collected samples of water on both sides of the river, and they were subsequently examined by Dr. Amyot, with the result that the specimens taken on the American side showed the presence of bacc. coli. com.

The cases of enteric fever which happened in the Village of Enniskillen were no doubt due to pollution of the water supply in each instance. Reports have already been handed in on both of these outbreaks.

Smallpox has been reported from 42 centres during the month of January, viz.: 4 cities, 12 towns and villages, and 26 townships, a total of 42 municipalities.

There have been 196 cases, with 10 deaths, the latter occurring in the following places : Galt, 5 ; Preston, 2 ; Jocelyn Township, 2 ; Toronto, 1.

In eight cases the origin of infection has been found to be outside the Province, 5 being traced to the State of Michigan, and one each to New York City, Minnesota, and Dakota, while six of the municipalities trace the infection to the Galt cases, at a time previous to the putting on of quarantine in that town.

The chief centre for the month was Galt, which reported 65 cases, with 5 deaths. Here, as in many other places in the Province, the first cases were thought to be chickenpox, and there had been a large number of exposures before the true character of the infection was recognized. A notable feature of this outbreak is the severity of type, fully one-half of the cases being either confluent or semi-confluent, and the first patient who died suffered from the haemorrhagic form.

I saw 30 of the Galt cases, and, as showing the effects of vaccination upon the disease, found that none of these persons at the time of their exposure had either been vaccinated or revaccinated within seven years ; some 8 had been vaccinated after exposure :

17 never vaccinated.
4 vaccinated in infancy ; ages, 36, 38, 46, 54 ; showing 1 scar each.
1 vaccinated in infancy; no scar evidence.
6 vaccinated 2nd or 3rd day after exposure.
1 vaccinated 3rd day.
1 vaccinated 3rd day ; unsuccessful.

The 17 vaccinated were classed as follows : 3 confluent, 5 semi-confluent, 9 discrete.

The 4 vaccinated 30 to 40 years ago with only one scar : 1 confluent, 2 semi-confluent, 1 discrete.

The 6 vaccinated after exposure, and on whom there was a more or less satisfactory evidence of the reaction of the vaccinia : 3 semi-confluent, 3 discrete.

The 1 showing no reaction of vaccinia had the disease in the confluent form.

It was particularly noticeable in regard to the six persons vaccinated after exposure that desquamation was hastened, and the rash was very scanty upon the extremities.

The five persons who died were all unvaccinated.

As showing the immunity conferred by even one successful vaccination, I would quote briefly the following examples which have come under my notice during the past month :

At Galt, Mrs. H., aet. 32 ; vaccinated 17 years ago, as evidenced by two good scars, was the only one of four in a house who did not contract the disease.

At Galt, Mr. L., aet. 57 ; vaccinated in childhood ; 2 scars ; the only one of four.

At Galt, Mr. K., aet. 43 ; vaccinated in childhood ; 1 scar ; the only one of 9 to escape the disease.

At Wilmot Township, Mrs. S., aet. 45 ; vaccinated 43 years ago ; 1 scar ; was the only one of a household of 9 who was unaffected.

There are two regrettable facts incident to the present outbreak of smallpox.

The first is the persistent manner in which medical men generally continue to diagnose the disease as chickenpox, and thus large numbers of persons become exposed to a disease which otherwise they would avoid.

The second fact, and one for which many of our towns are paying dearly, is the general neglect of vaccination, both primary and secondary, and the great difficulty experienced by the Local Boards of Health in the enforcement of what should be a readily accepted operation.

At first it would seem somewhat difficult to account for these unfortunate conditions; but experience teaches that the medical practitioner often, and the Medical Health Officer in most instances, is unwilling to bear the onus of responsibility of pronouncing upon many of the mild cases which occur in the initial stages of an outbreak, and which present few, if any, of the symptoms so usual, with what is generally taught, as typical smallpox. To do so is to antagonize a portion of the community, and bring himself into opposition with many who are just waiting an opportunity ; if he is M.H.O. he is assuming a responsibility both for himself and the municipality, so both give the patient " the benefit of the doubt," a doubt too often born of ignorance and inexperience as regards smallpox and its differential diagnosis. Thus it is that the municipality suffers, and no local physician or Medical Health Officer assumes responsibility; as a consequence matters progress, and ultimately this Board is appealed to, its officer is expected by the local authorities and the medical men to assume all responsibility for errors in diagnosis, while they assume the role of injured innocence, or, worse still, of covert opposition.

If it is considered for a moment what the average township and village pays a M.H.O. for his services, and at the same time what they expect from him, even for extra services during an outbreak of any infectious disease, not to speak of the many calls made upon him from week to week, it cannot be wondered at that he should hesitate to assume such a responsible role as just referred to.

What, then, is the practical solution of this difficulty which is increasing, instead of decreasing ? There must be some union of municipalities—a union which can offer sufficient compensation to an officer who shall devote his whole time to the duties of the office, in the same manner that some of the cities of the Province now engage their M.H.O.; and for this purpose the several municipalities of a county or portion of a county may be united. With the increased remuneration must come that very essential requirement on the part of the M.H.O.—a standard of qualification, and this Board should in the public interest institute some system whereby the necessary information and instruction can be secured, and the Province thus be supplied with trained Medical Officers of Health.

The failure on the part of the M.H.O. to do anything more than merely fill the position from year to year has in a large measure resulted in the general public ignoring even the wise provisions of the Vaccination Act. Hence it is found that in many of the rural districts infant vaccination is seldom if ever resorted to, and only in times of outbreaks have the public availed themselves of this protective measure.

Report of Smallpox Cases for the Month of January, 1903.

Cities (4).

Brantford	5	Windsor	1
St. Thomas	10		
Toronto (1 death)	4		20

Towns and Villages (12).

Amherstburg	3	Pembroke	2
Burlington	1	Petrolea	1
Deseronto	1	Preston (2 deaths)	4
Drumbo	1	Sault Ste. Marie	1
Galt (5 deaths)	65	Vankleek Hill	1
Hawkesbury	8		
Midland	1		89

Townships (26).

Anderdon	3	McNab	1
Bayham	1	Medonte	1
Beverley	2	Moore	10
Blenheim	2	Portland	1
Cambridge	3	Plantagenet, S.	2
Camden	1	Rawdon	1
Dumfries, N.	1	Stamford	3
Eldon	1	Tay	9
Emo	4	Thurlow	2
Finch	1	Tiny	9
Hawkesbury, West	1	Indian Reserve (Deseronto)	13
Himsworth, N.	1		
Hinchinbrook	4		87
Jocelyn (2 deaths)	9		
Levant	1		196

Report of Smallpox Cases for the Quarter Ending Dec. 31st, 1902.

Cities (3).

Ottawa	4	Windsor	2
Toronto	8		
			16

Towns and Villages (8).

Copper Cliff	1	Streetsville	1
Deseronto	1	Thamesville	1
Pembroke	10	Waterloo	1
Rockland	2		
Sparta	1		18

Townships (25).

Alice	37	Plantagenet, South	17
Anderdon	2	Puslinch	1
Bayham	2	Sheffield	1
Caledonia	3	Stamford	1
Caradoc	6	Tecumseh	1
Dorchester	13	Torbolton	12
Fitzroy	7	Toronto	9
Jocelyn	1	Wainfleet	3
Metcalfe	2	Westmeath	1
Muloch	1	Widdifield	4
Norman	1	Wylie	2
Orillia, South	1		
Oxford, North	1		132
Oxford, West	3		

Camps (1).

Collins	1		
	1		167

REPORT ON ENTERIC FEVER AT NIAGARA FALLS.

By C. A. Hodgetts, M.D., Medical Inspector.

Nov. 11th, 1902.

Dr. P. H. Bryce, Secretary Provincial Board of Health :

Dear Sir,—A report having been received that there had been a number of cases of Enteric Fever in the Town of Niagara Falls, I proceeded there under instruction on October 8th ult.

From personal interviews with the medical practitioners, I learned that there had been a few cases during the past few months, many of a mild type, and most of these were supposed to have contracted the disease on the American side of the river. On the whole, the outbreak had been nothing like that of the previous year. At the date of my visit there were only three cases of fever, all in the practice of Dr. Killem. One contracted the disease on the American side, where he worked ; the other two were residents of the town.

In company with Dr. McGarry, Jr., I visited the pumping station of the town water supply, where I found that the water was more turbid than usual, owing to the construction works now in progress further up the river, and the cofferdam enabled me to inspect the river bed above the intake, where I found a private sewer was being extended out into deep water by a series of iron pipes, whereby there would be direct contamination of the town's water supply.

I also found that the closets on the river's edge were kept in a very unsatisfactory condition.

On the Canadian side I took three samples (C. I., C. II., C. III.), as follows :

C I. Power-house well: temperature, 60° F.

C II. Intake: temperature, 57.5° F.

C III. Town tap: temperature, 61° F.

Proceeding to the American side, I found that the city receives its water supply from two sources : the city waterworks and the Power Company, the latter being the new source of supply for the upper portion of the city, and takes the water direct from the river, whilst the former takes the water from the old canal, the power-house being close to the Falls. Three samples were taken on that side of the river (U.S. I., U.S. II., U.S. III.), as follows:

U.S. I. Tap at pumping station, city waterworks: temperature, 60° F.

U.S. II. A fountain near power-house: temperature, 50° F.

U.S. III. Town tap (after water had been aerated and filtered, as supplied to consumer): temperature, 60° F.

I have much pleasure in appending Dr. John Amyot's Report on the examination of the six specimens, from which will be seen the general difference between the Canadian and American waters ; the pollution by the Buffalo sewage of the American waters being quite evident.

Respectfully submitted.

CHAS. A. HODGETTS, M.D.,
Inspector.

Received from Dr. Hodgetts personally, 6 bottles of water, in ice.

Recd..... Oct. 11, 1902.
Collected. " 10, 1902.
Analysis . " 10, 1902.

Test Numbers.	Designation.	Turbidity.	Color.	Odor.	No. of bacteria per 166.	Colon bacillia.	Chlorine.
2,934	"C I."	None.	None.	None.	350	None.	10
2,935	"C II."	None.	None.	None.	580	None.	10
2,936	"C 3"	None.	None.	None.	210	None.	9
2,937	"U.S.I."	None.	None.	None.	10,000	Present 200	10
2,938	"U.S.II."	None.	None.	None.	90,000	None.	11
2,939	"U.S.III.'	None.	None.	None.	2,000	Present 128	10

JOHN A. AMYOT.

REPORT ON ENTERIC FEVER IN THE VILLAGE OF BURK'S FALLS.

By. C. A. Hodgetts, M.D., Medical Inspector.

Dr. P. H. Bryce, Esq., Secretary Provincial Board of Health :

Toronto, October 24, 1902.

Dear Sir,—The appearance of several cases of enteric fever in the village, which has a population of about 600, caused the local physicians and the Local Board of Health to transmit to the laboratory several samples of drinking water obtained from various wells of the village, upon which the inhabitants depend for their supply.

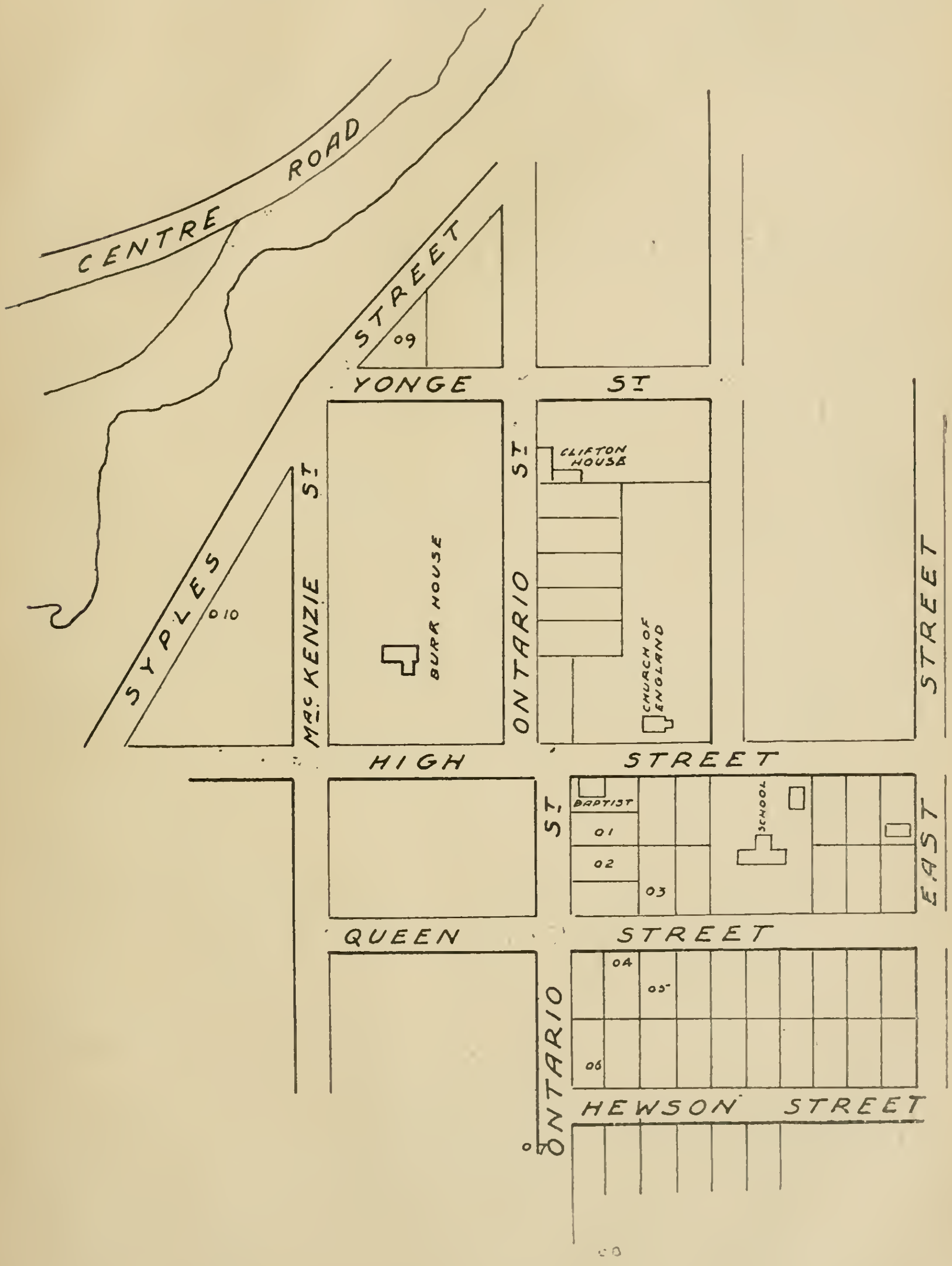
The village is situated on the south bank of the Magnetawan River, from which it rises rather precipitously, the highest point being on the line of High street, and about 350 yards distant.

From this ridge the land slopes in a southerly direction towards Hewson and Ontario streets, and in this lower ground are found the wells which chiefly supply the villagers with water.

On this sloping land, and within the area of two blocks, bounded by High, Ontario, Hewson and East streets, there reside nearly 150 people. There are in the district 32 cesspools, or closets, at least 3 pig-pens and the same number of cow sheds, while there are only six wells, one of which, No. 4, may be called "the town pump," as there are householders who contribute yearly for its being kept in repair, and from it the school on Queen street is supplied.

I cannot pass on further to consider the outbreak without first referring to the cesspools. That such an accumulation of filthy pits should be permitted either by the individual owners or the village Board of Health seems almost incredible—one, in the cellar of a house in which fever existed, was nearly full to the top of the seat—many others were equally as bad, and the odor was unbearable. In all of these cases the surface of the ground around was saturated with the overflow. In two instances the pig pens abutted on these closets, and in one the atmosphere was reeking with the stench emanating from the execreta of cow, pig and man—the quadrupeds were to be pitied, while the ignorant man was deserving of condemnation and punishment. If the

Burk's Falls.



example were an isolated one we might pass the subject by, but experience teaches me that it is but a specimen of what exists in many of our larger towns, and often, I am ashamed to say, cities of this Province. Below, and encircled by these 32 pits, are to be found the wells numbered 1 to 6 inclusive, none of them 20 feet deep; Nos. 2 and 3 each being situated in the cellars of the house.

The ridge is gravelly, and a description of the various strata cut through in digging No. 3 will be a good indication of the others. They are as follows:—Sandy loam, yellow sand, light sand (firm), hard pan, sand, bottom of hard pan; in this bottom the water flows from the east and northwest.,

As regards the other four wells situated beyond this area, No. 8 is much further to the south; No. 7 is on the west side of Ontario Street, close to the road, and not far from the edge of the second dip into the lower valley; it was 75 feet deep. Nos. 9 and 10 are some distance from the others, and although a little distance apart, are on the same level; the former is 16 feet deep, with a rock bottom; flows continuously. It evidently is contaminated by surface water, for the doctor states that at times it is tainted with coal oil, apparently washed in from the site of an old oil warehouse, just adjacent. No. 10 was originally a spring; the land around is chiefly made land, largely sawdust. It appears that the drainage from the house adjoining is carried away by wooden pipes, from a point near the outer side of the house to the river, and it is not improbable that there is a leakage therefrom, which would readily find its way into the well through the sawdust.

By reference to table it will be noticed that there were seen 14 cases—9 adults and 5 children—and it was found that all the children drank the water of well No. 4 when at school, and of some or other of the others, and 4 adults drank of water from the same source; two from No. 3; one from No. 8; one from Nos. 6 and 10, and one from Nos. 9 and 10. It was further ascertained that one adult drank during his business hours of No. 4, while the other 7 members of his household drank only from the deep well No. 8, and he was the only one attacked with the fever.

The possibility of the disease being communicated by the milk is very remote, as no two families had from the same source.

The summer had been a very wet one, and as a consequence, the ground became saturated, filtration being impossible at times, and impurities would be washed into the adjoining wells or soak through. As most of the closets were pits, there was every opportunity for this to happen, as each rainstorm would fill them, and before the next the liquid would have drained away into the pits or wells in the lower ground. It was further learned that last year enteric fever had occurred in two houses adjacent to, but on the east side of East Street, and allowing for either the imperfect disinfection of excreta at that time, or what is more probable, the depositing of infected excreta in the pits before the fever was diagnosed, it is not improbable these may have been factors in determining the present outbreak.

Samples from each of the wells were collected by Dr. Partridge, M. H. O., and forwarded to Dr. Amyot for examination.

I would strongly urge the immediate adoption of some system for the removal of "night soil" from the premises, and the cleaning of every cesspool in the village. The wells should all be closed, else a repetition of this year's experience may happen next, only with a more widespread diffusion. At the same time there should be instituted a system of public water supply, which possibly could be obtained on the north bank of the river, and at such an elevation as to give ample force for all purposes.

In conclusion, I beg to thank Dr. Partridge, M. H. O., and Dr. Barber, for the kind assistance rendered me in making the investigation, and for the deep interest taken by them in this important matter.

Chas. A. Hodgetts,
Medical Inspector.

LIST OF CASES.

	Name.	Street.	Patient.		Water supply.	Milk Supply.
			Adult.	Child.		
					Well No.	
1	Harris	Ontario	1	0	4 & 7	Blakely.
2	Bailey	“	1	0	4	Own cow.
3	Rutter	“	0	1	4	Wilson.
4	Hillier	Queen	2	0	3	Westover.
5	Couture	Ontario	0	1	4	Hall.
6	Pates	“	1	0	6	....
7	Blakely	“	0	1	4 & 6	Own cow.
8	Stevenson	Hewson	1	0	6 10	Burk.
9	Stuart	Queen	2	0	4	....
10	Ward	“	0	1	4	Own cow.
11	Hillis	East	0	1	4	Baker.
12	McClelland	....	1	0	9 & 10	....
			9	5		

Note.—Since writing this report, I have been informed by Dr. A. W. Partridge, M. H. O., who has taken the greatest interest in the investigation, that a case of enteric fever existed in one of the houses on High Street, no care being taken in disinfection of the dejecta.

The doctor also reports five other cases having occurred since the date of my inspection. C. A. H.

REPORT ON ENTERIC FEVER OUTBREAK IN SAULT STE. MARIE.

By C. A. Hodgetts, M.D., Medical Inspector.

October 17th. 1902.

To P. H. Bryce, M.D., Secretary:

Dear Sir.—Having learned while on official business in Algoma that there was a large number of enteric fever cases in the town, I called on Dr. McCaig, Medical Health Officer, and found that, for at least two months, the disease had been present, and was now (September) somewhat epidemic. Many cases had been of a mild type, but several deaths had occurred, amongst them one of the leading medical men dying.

Owing to there being no system of notification, the M. H. O. was unable to give me the exact number of cases that had occurred, and it was difficult to obtain the information from the medical men, owing to the briefness of my visit, but a conservative estimate would place the number at 120.

On visiting St. Joseph's Hospital, I found there 46 cases, classified as follows:

	Cases.
1. Non-residents	11
2. Residents—	
(a) West of Bruce street	24
(b) East of Bruce street	11
	—35
	46

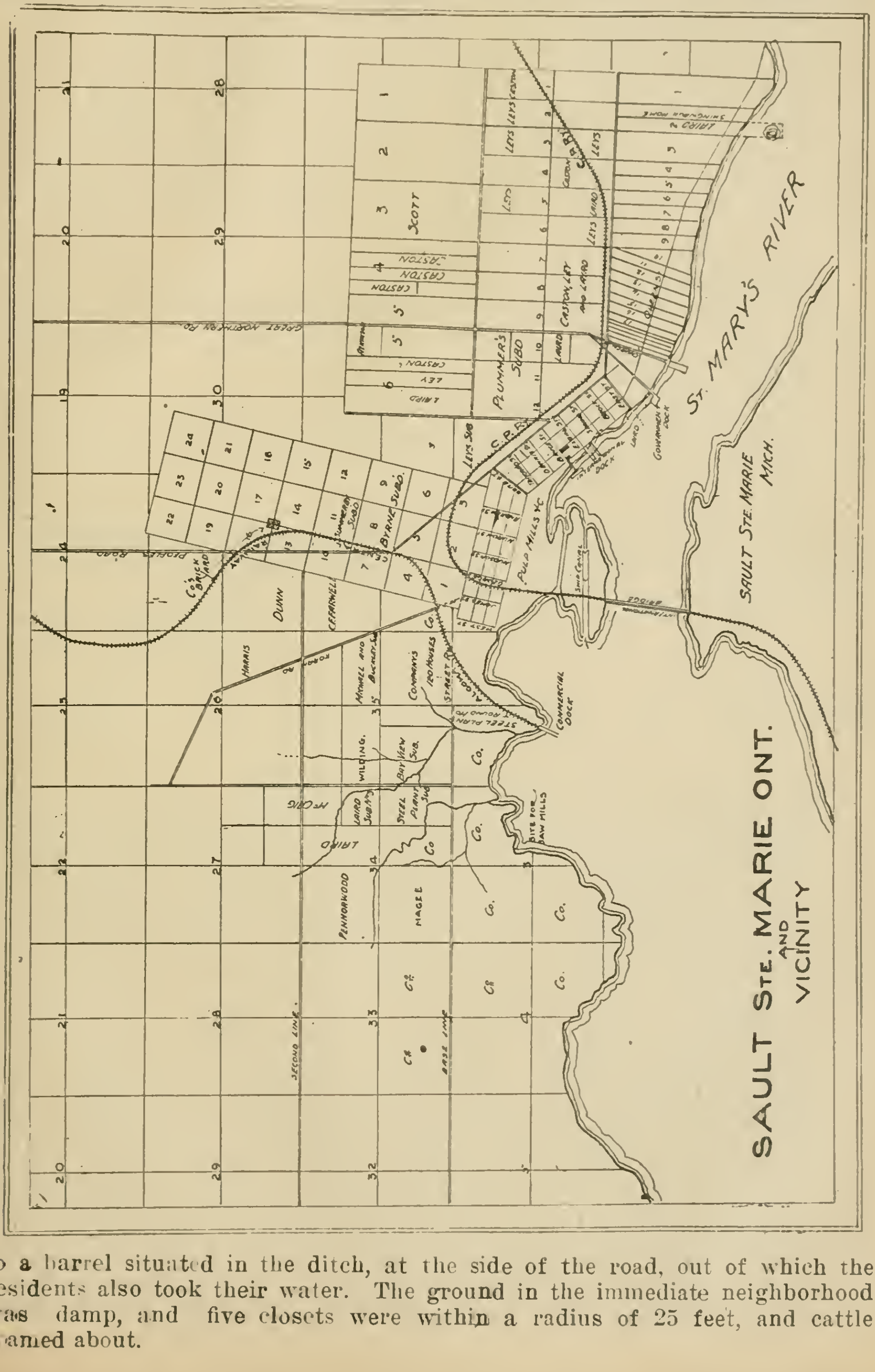
In addition to the cases seen in the hospital, the homes of 13 other patients were visited, and the premises examined. They were all of the class "Residents," in group "A" and in "B," making in all 59 cases included in the enquiry, eleven of whom were non-residents—one from the State of Michigan, and 10 from the adjacent country, leaving for consideration 48 "Residents." One of these had been acting as ward attendant on the enteric patients in the hospital, and no doubt the disease was communicated to him by want of proper care on his part of antiseptic measures. Of the remaining 47 it was found that the source of their water supply was as follows:

Town water	11
Well or spring water	23
Town and well or spring	12

The supply of milk was so varied, and the information on this point so difficult to ascertain from the hospital cases, who were chiefly from boarding-houses, that I have not taken it into consideration, although it is possible that this might have been a source of contagion—as those supplying milk would derive their water from wells or springs, which would be used to wash the cans and vessels; and there is the further possibility of some of it being used for adulteration.

As the larger number of those attacked drank water from the springs or wells of the town, 76 per cent., attention was directed to an examination of the section west of Bruce street, where the chief source of water supply was other than that supplied by the town, and in which 68.5 per cent. of the "Resident" cases occurred. Here the streets and houses are all new; the character of the soil being layers of either sand or loam on clay or rock; a district which, but a year or two ago, is said to have been the dumping ground for night soil and garbage. The ground itself was found to be soft and boggy, due, no doubt, to the fact that the season had been a wet one. There was every evidence that kitchen and other refuse was thrown out, without any regard to health or decency, and cattle roamed about; in fact, everything pointed to an easy pollution of the springs and wells.

A striking instance of the primitive and careless methods of the residents was seen in the spring on Grosvenor street. The street itself is a new one, with a gutter on either side. About ten feet distant from the gutter on the north side is the spring. The receptacle for the water is a hole in the ground, about 4 feet in diameter, its sides composed of small stones, and walled above the ground for about a foot; and at the time of my visit partially covered with a few boards fastened together. It had apparently been recently cleaned, for some of the slime adhering to the stones had been scraped off, though this might have been done by the scraping of the pails against them. Floating in it were some pieces of bread, possibly thrown there by the children sent to draw water. There was two feet of water, and it was clear and cool, and of agreeable taste. A second and similar receptacle lies about eight feet further off. Its condition was dirty, weeds grew in it, and at the bottom lay water-soaked sticks with other rubbish. From either or both of these the water found its way underground



to a barrel situated in the ditch, at the side of the road, out of which the residents also took their water. The ground in the immediate neighborhood was damp, and five closets were within a radius of 25 feet, and cattle roamed about.

The result of my inspection of the premises east of Bruce street is anything but satisfactory, and the condition calls for prompt action on the part of the local authorities. It is an impossibility for the wells to remain uncontaminated so long as cesspools exist in the condition I found them; for while one careful resident with a well keeps his own premises clean, yet his surroundings are such that pollution must come from soakage.

As there was a sufficient number of cases amongst those seen who had only taken of the town water, I visited the intake in company with Dr. McLean and Mr. Craig, engineer of "The Amalgamated Companies." The water was clear and bright, flowing at the rate of about two miles in 24 hours; the banks on both sides of the canal were clean and free from any buildings from which anything might come that would be likely to pollute; the small accumulation of bark at the pulpwood dump, close to the mill, being merely the daily quota, and could do no harm.

It having been suggested that the water might be polluted by discharges from the steel plant, I found that there is a large concrete sewer running from this place and emptying into a creek which flows into the river below the company's works, and there is no discharge from the steel plant other than into this sewer.

I have requested the M. H. O. to forward for examinations samples of water taken at both intakes, and at several taps in the town; also of the Grosvenor street spring, and of one on Spring street; also any others he may choose.

I recommended the M. H. O. to instruct the public to boil all spring and well waters, and would further recommend the immediate closing of all springs and wells in the town, and the adoption of some system for the regular inspection of premises and the cleaning of cesspools.

C. A. HODGETTS,
Medical Inspector.

CHLOROFORM AND DISEASES OF THE STOMACH AS CAUSES OF SUDDEN DEATH.

By Dr. J. J. Cassidy, Toronto.

Gentlemen: In popular estimation, sudden death, or death occurring rapidly in a person who, apparently at least, was a short time before in good health, may be due to murder, suicide, or the existence in the body of the deceased of unknown pathological conditions. Whatever the cause of sudden death may have been, and however obscure the circumstances surrounding it may be, people in general believe that an autopsy will reveal the cause of death, and in formulating this opinion the public mind and the medical mind are not far asunder.

This opinion certainly appears to be most reasonable, and, in the majority of instances of sudden death, an adequate explanation of the cause of the same may be confidently expected if a careful autopsy is made.

As Watson says in the 4th chapter of his Practice of Medicine:—"The several modes of dying, then, in cases of sudden death, are clearly enough made out. Let me briefly sum up the conclusions at which we have arrived. Life cannot be maintained without the circulation of arterial blood, and whenever a person dies, he dies either because no blood circulates through his arteries, or because venous blood circulates through them.

When it comes to pass that no blood is circulated through the arteries, we say that death occurs in the way of syncope, and this is of two kinds. In the one there is not blood enough received by the left side of the heart to stimulate its chambers to contract, or to be sent onward by their contraction; in the other there may be blood enough, but the heart has not sufficient power to contract upon it. Also there are two ways in which death may be brought about in consequence of the circulation of venous blood through the arteries. In one of these the first step is the sudden shutting out of air from the lungs; the blood which arrives in those organs is not aerated, or rendered arterial, but circulates again as venous blood, producing a failure of the animal functions and weakening of the muscles, till it finally stagnates in the capillaries of the lungs themselves. In the other the animal functions are the first to suffer—insensibility occurs—the power which governs the movements of respiration, the respiratory centre, is in abeyance, the breathing ceases, and organic life is extinguished as in the former case."

These simple, yet lucid, conclusions of the English author are as useful to-day as when they were written, 59 years ago. A difficulty, however, is encountered by the pathologist who makes application of Watson's conclusions to the circumstances of an autopsy in which important anatomical changes are not discoverable. For instance, an individual reported to be in good health, who can talk, walk, and conduct the ordinary business of life fairly well, lies down upon an operating table, and after taking a few whiffs of chloroform, expires suddenly. Who can explain the deadly action or the primary effect of chloroform in this case? We all know that when chloroform is applied in a liquid state to the bare skin that it proves to be very irritating, acting like an acid, and practitioners precede its administration as an anaesthetic by the application of vaseline to the lips and nose of the patient, in order to save these parts from irritation. We are, however so accustomed to see even babes inhale it, that we cease to regard it as a specially dangerous drug, unless we are unfortunate enough to witness a death due to its effects. I shall not refer you to all the dangers involved in the administration of chloroform, but shall allude more particularly to the danger of primary shock.

Lyman says:—"It is during the initial stage of nerve excitement that such deaths have occurred, before the blood and the tissues could be saturated with the anaesthetic. The peripheral excitement of the fifth pair of nerves and of the respiratory filaments of the pneumogastric nerve by chloroform may be sufficient to inhibit the respiratory centres in the medulla oblongata, thus producing respiratory and cardiac arrest, just as a powerful mental emotion or a painful peripheral impression may effect the same result."

Prof. Poncet of Lyons, in reference to syncope from chloroform, says:—"The patient's death is said to have been caused by shock from chloroform, and is due to primary or laryngo-reflex syncope. An autopsy reveals nothing. It furnishes no explanation, and leaves the surgeon more perplexed than he was before." I shall not allude to the danger of primary syncope in chloroform administration further than to say, that, although chloroform is for some patients an active poison, capable of producing sudden death after a few inhalations, we do not possess any data as to the coefficient of susceptibility and of resistance presented by such on such a patient to these deadly vapors. In other words, an administration of chloroform to a person who has not taken it before may be looked upon as an experiment, extremely hazardous for some few persons, innocuous for others—the great majority. The real difficulty is that there are certain persons reported to be in good health who cannot take chloroform without incurring the danger of sudden death, and medical science cannot diagnose such cases.

There are others forms of sudden death, occurring in persons reputed to be in good health, which cannot be explained. An autopsy is demanded, and the jury is surprised when the pathologist who makes the autopsy informs them that no adequate cause of death has been revealed. Popular imagination naturally begins to conjecture a number of causes, criminal or otherwise, which might or might not cause sudden death. As a contribution to the subject I propose to lay before you a brief abstract of an article read before the Academy of Medicine, Paris, March 15, 1902, by Professor Lancereaux.

His paper is entitled, "Rapid or Sudden Death of Gastric Origin." He said that sudden death occurring in persons who are apparently in good health is relatively frequent, but that the cause of it is very imperfectly understood. Deaths by embolism, by the rupture of an aneurism, or a rupture of the heart are rare. In many cases of sudden deaths nothing of importance is discovered when an autopsy is made ; the heart is empty, as if death had been due to a spasm.

There is one variety of sudden death which is of rather frequent occurrence. It supervenes during the course of disease of the stomach. Death from this cause usually happens during the night, towards the end of the forenoon, or the end of the afternoon. The heart is sound, the nerve centres do not appear to be affected. A case of sudden death in which an autopsy revealed such conditions was mentioned. Prior to the attack which terminated fatally, this person had had a medical consultation, after which repeated fainting fits occurred, terminating in death. The fainting fits had been preceded by disorders of the digestive organs. Professor Lancereaux described a second case of a similar kind. He concluded that the preventive treatment of such a fatality would consist in endeavoring to ward off or cure dyspepsia."

In presenting this paper for your consideration, I wish, in the first place, to draw your attention to the fact that the idiosyncracy of an individual may cause sudden death from the inhalation of a small quantity of chloroform, no appreciable lesion of a vital organ being found at the autopsy to account for the unexpected result. In the second place, I think that the facts presented by Professor Lancereaux are deserving of the careful consideration of physicians, coroners, and medico-legal experts. His opinion that sudden death may occur from gastric disorder with no lesion discoverable at the autopsy, may help to explain a sudden death, the cause of which otherwise would remain obscure.

All of which is respectfully submitted.

J. J. CASSIDY.

REPORT OF COMMITTEE ON WATER SUPPLY RE SOUTHAMPTON PUBLIC WATER SUPPLY.

Toronto, April 9th, 1902.

Mr. Chairman and Gentlemen :

Your Committee begs to report on the plans and proposed source of water supply for the Town of Southampton. Herewith is submitted a copy of the analysis made in the laboratory of the Board. As stated in the letter of Mr. J. Galt, Engineer in charge, the source of supply is taken from a basin sunk in the sandy lake shore, and so far has been shown ample for the supply of the town.

The principle of taking water from such basins has been successfully utilized at Meaford, Kincardine, Port Hope, etc., and where the location is properly selected and sources of pollution from the land side are prevented, these have proved to be amongst the most satisfactory sources of public water in the Province. Analysis at other points has shown these waters to be, under ordinary conditions, underground waters from the higher grounds, and to have the qualities common to sub-surface waters.

In case much pumping is required, it is found that the basin obtains its supply from the lake as well as by percolation from the land side.

With proper care in protecting the basin from surface contamination, nothing more is required for insuring in such cases a clear, pure water in every way fitted for public use.

Your Committee takes pleasure in recommending the source of supply.

Respectfully submitted.

H. E. VAUX.
P. H. BRYCE.
J. DOUGLASS.

REPORT BY COMMITTEE ON SEWERAGE RE EXTENSION OF STRATFORD SEWERAGE SYSTEM.

Gentlemen : Your Committee begs to report upon the proposed sewer extensions in Stratford, referred to in accompanying plan and statement of the City Engineer.

With regard to the first extension, there is an alteration to some extent of the original McDougall plan. The change, however, is a slight one, and is evidently intended for the convenience of ratepayers. Your Committee approves of the proposed change.

As will be seen in the drawing, the second extension is an alteration of the original plan in which it is proposed, owing to a heavy cutting to follow a watercourse through private property. Certain provisions of the Municipal Act all provide for drainage outlets across private property ; and in this case it will be necessary to obtain consent and make compensation for use of land where proposed sewer is to run.

There seems no objection, so long as the city council arranges these matters of detail, to the proposed change.

Your Committee begs, therefore, to recommend that permission to make the proposed change be made.

It may be mentioned, that with extension of the coke-beds to seven, the area of the filters at Stratford, is now such, as with proper supervision to insure a good effluent from the sewage filter-beds.

All of which is respectfully submitted.

E. E. KITCHEN.
P. H. BRYCE.
JOHN DOUGLASS.

REPORT OF COMMITTEE ON SEWERAGE RE DISPOSAL OF WOODSTOCK SEWAGE.

Toronto, April 9th, 1902.

To the Chairman and Members of the Provincial Board of Health :

Gentlemen,—Your Committee begs to submit herewith its report on the proposed sewage disposal works of the Town of Woodstock.

The following report of W. M. Davis, C.E., Engineer in charge, is presented as a part of the report.

The various facts set forth in the following report give the Board an accurate idea of the work to be done, and Mr. Davis' scheme for accomplishing it:

The special reference to the very high amount of water pumped daily is of great importance, and points to the same conclusion referred to in the report of your Committee in January last, on the inexcusable waste of money in pumping in many cities on this continent, and the consequent greatly increased cost and difficulties in dealing with the sewage by a filtration plant.

How far the Board can go in regulating this first important point is not very evident ; but it certainly should support such recommendations as those by Mr. Davis for the use of meters for regulating the amount of water.

The scheme proposed is an extension both in amount and in detail of the sewage farm scheme, which this Board approved of in 1895, for the north water-shed of Woodstock, and includes the construction of septic tanks and filter areas at two points, one for the north drainage area and one for the south.

Without entering into these in detail, which are set forth in the report, it will be seen that the scheme provided for by Mr. Davis refers to the necessity for preliminary supervision of the character of certain industrial sewages, before allowing them entrance to the common sewers.

It is sufficient to say that the scheme commends itself to your Committee as scientific and up-to-date, and likely, should it be introduced, to remove all reasonable grounds of complaint regarding pollution of the Thames, if the farm be carefully managed and supervised by an experienced engineer and foreman.

Your Committee recommends the Board's approval of the proposed scheme.

All of which is respectfully submitted.

(Signed) E. E. KITCHEN, M.D.,
P. H BRYCE, M.D.,
J. E. DOUGLAS, M.D.

Berlin, December 23, 1901.

F. J. Ure, Esq., City Engineer, Woodstock.

Sir,—I beg to submit the following report on the disposal of the sewage of the city of Woodstock and on the sewerage of the South Watershed for the consideration of your Council.

The situation of the city on undulating ground, each of the streets having a rapid fall which quickly sheds the storm water, makes the separate system of sewerage which excludes the storm water peculiarly adapted for its requirements for the following reasons :

1. The small flow of the river Thames renders it imperative that the sewage of the city should be purified before being discharged into the river, and as the cost of purification depends to a great extent on the volume of the sewage it is desirable that the storm water should be separated from the sewage.

2. The steep grades carry the storm water swiftly to the nearest water course, whence it can without assistance find its way to the river without causing damage, so that while occasional stretches of covered drain may be necessary for the conveyance of storm water no connected system will ever be required.

The earlier sewers were designed to carry both storm water and sewage, but a trunk sewer to take only the dry weather flow from these sewers will work satisfactorily, as is shown by the experience with the North trunk sewer, in which case an overflow to permit storm water to run into the open drain is provided in the connecting manholes. I would recommend that the same device be adopted for similar cases in the South watershed, and that in constructing sewers in the future the separate system be strictly adhered to.

Quantity of Sewage. The weir measurements of sewage with which you have supplied me show the daily flow of sewage to be, in the North watershed 340,000 gallons ; in the South watershed 130,000 gallons, total 470,000 gallons per day, which does not include the Simcoe Street or Dundas Street West sewer.

I have compared these figures with statistics from places about the same size and similarly situated and the quantity appears excessive. For instance Berlin with 10 miles of sewers has 327,000 gallons of sewage per day. Of this about 30 per cent. comes from tanneries and large factories which take large quantities of water. The quantity of domestic sewage would therefore be 228,900 gallons for 10 miles of sewers, or at the rate of 23,000 gallons per mile.

In the North watershed of Woodstock we have 6½ miles of sewers and 340,000 gallons daily of domestic sewage, or at the rate of 52,000 gallons per day per mile, more than double the amount discharged in Berlin. The reasons for this difference are apparent. Woodstock has a practically unlimited supply of excellent water, few restrictions are placed on its use, and the excessive quantity of sewage is undoubtedly due to waste of water.

In Berlin, on the other hand, the conditions are different. The supply of good water, though ample for all legitimate purposes, will not permit reckless waste. The Water Commissioners have accordingly encouraged the use of water meters, with the result that half the services are metered. Other services are restricted in their use, and all services are inspected periodically in order to detect leaky fixtures and careless or improper use of the water.

In the interest of economy in the disposal of the Woodstock sewage the waste of water should be reduced to the minimum. A great deal may be accomplished by house to house inspections, but there are no means so effectual as the introduction of meters.

Trunk Sewer. A trunk sewer for the South watershed should follow approximately the course shown on the plan from the corner of Norwich Avenue and Hounsfield Street down to the River Thames, a distance of about 11,000 feet, the diameter of pipe to vary from 8 inches at the head to 15 inches at the outlet, with grades shown on the profile. The sewer running half full will provide for a population of 7,000 people. Manholes about 500 feet apart would be necessary, and a flush tank at the head of the 8-inch pipe. Cedar Creek would be crossed by means of an inverted syphon, the manholes at each end being connected by cast iron pipe. A portion of the sewer between stakes 70 and 93, on account of the grade coming so near the surface of the ground, will require additional covering, as shown by dotted lines on the profile. For this portion of the sewer an alternative location on Main Street is practicable without adding to the total cost.

Disposal of the Sewage. Of late years many tests have been made and much has been written of bacteria treatment of sewage in septic tanks and contact beds, the latter being usually constructed of coke brize or screened gravel. In the septic tank anaerobic bacteria, which thrive and multiply in the absence of air, decompose and liquify the solids, liberating various gases during the slow progress of the sewage through the tank. In the contact beds the effluent from the tank is acted upon in the presence of oxygen by another species of bacteria called aerobes which depend on a supply of oxygen for their existence, and a high degree of purification is attained.

In some of the earlier disposal plants installed it was claimed that in the tank the whole of the solids were liquified leaving no sludge. A more prolonged experience however demonstrated the fact that on the inorganic matter at least the anaerobes can have no effect, and therefore provision must be made for the removal of a certain amount of sludge from the tank.

This system has been introduced in many places in the last two years and, while the issue has not always been as satisfactory as was anticipated, a close study usually reveals the fact that any failure or partial failure is due to careless management or to the admission to the tank of antiseptics which check the action of the bacteria in the tank. An epitome of the various results would indicate that with domestic sewage well designed tanks intelligently managed will produce satisfactory results, but that some factory and tannery refuse may require preliminary treatment before it can safely be admitted to the system.

In my report to the Woodstock council of 20th April, 1895, the question of sewage disposal is discussed at some length. The advantages and disadvantages of different systems are enumerated and intermittent downward filtration recommended as best suited for the North watershed of Woodstock. In the six years that have elapsed since that time different systems, of which I have knowledge, have had a longer test and the results have been satisfactory, and I am still of opinion that intermittent filtration will best satisfy the requirements of Woodstock ; but I would advise the use of septic tanks in connection which will enable the beds to be worked at a higher rate ; that is, will enable a much smaller area of land to do the work and reduce the probability of the beds becoming clogged to a minimum. Near the outlet of the proposed trunk sewer is an area of about 3 acres of land of sufficient elevation above the level of the river to be available for filtration of the sewage. Test pits show this material to be 18 inches yellow sand on the surface with 5 feet of gravel and sand underneath.

I would recommend the construction of two concrete septic tanks 90 feet x 16 feet x 6 feet with two grit chambers 10 feet x 10 feet x 7 feet, and the levelling and underdraining of one acre of land for the purpose of treating the tank effluent. Tanks of this capacity will hold nearly 12 hours' flow each of the sewage discharged in the South watershed at the present time and one acre would be ample to provide for the effluent.

For the North watershed I am of opinion two tanks of the same capacity will be sufficient. It is true the quantity of sewage to be treated is larger than in South watershed but, the area of land available for filtration is greater and will filter much more quickly than the land to the South. I would advise the levelling of three acres for this purpose.

I would advise that the tannery refuse receive preliminary treatment before admission to the sewers. The nature of this treatment will depend on the nature and quantity of refuse.

With regard to the future, both tanks and beds will be so constructed that their capacity can be increased should occasion demand it, but a restriction of the waste of water would keep the quantity of sewage below the amount provided for for some years to come.

The following estimate provides for the construction of the works described above.

Main Sewer---	Estimate.
From Burtch Street to Outlet	$7,943.00
Hounsfield Street Branch	979.00
South Disposal Works	4,542.00
North Disposal Works	4,413.00
	$17,877.00

I am, Sir,
Your obedient servant,
Wm. Mahlon Davis.

REPORT OF STANDING COMMITTEE ON SEWAGE.

Toronto, April 9th, 1902.

Mr. Chairman and Gentlemen: Your Committee begs to report that the Government, acting on the recommendations contained in the Committee's report, presented at the last meeting of the Board, recommending that the Board be given such facilities as were necessary for carrying out a scientific investigation of such sewage disposal works as those of Berlin and other towns, where local complaints have arisen or may arise in future, has acted on the report, supplemented by a special report to the Premier by your Secretary, after a deputation from a number of cities had waited upon the Government, urging that a scientific assistance be given in the matter, and has appointed Mr. W. P. A. Robinson, B.Sc., Fellow in the School of Science, a chemist of several years' post graduate experience, to work in conjunction with Dr. J. A. Amyot, Bacteriologist of the Board, in giving special attention to the work at Berlin during the coming season, with a view to supplying the Board with such information as will enable it to make any additional recommendations to those contained in the Board's report of last October.

Dr. Amyot has, at my request, prepared the statement herewith presented of work already done, which contains a statement of conditions found similar to those reported upon by your Committee last October.

Dr. Amyot, after spending several days at Berlin, has now gone to Massachusetts to study the laboratory methods at the Lawrence Experimental Station, with a view of obtaining such information as will be of use in the enquiry.

It is hoped that at the next meeting your Committee will be in possession of such information as will enable it to take any further action in relation to the Berlin Sewage Farm which the situation demands.

All of which is respectfully submitted.
E. E. KITCHEN, M.D.,
P. H. BRYCE
JOHN DOUGLASS.

REPORT OF COMMITTEE ON SEWERAGE OF LISTOWEL.

Feb. 13, 1903.

Gentlemen: The Committee on Sewage presents for consideration the plans for the disposal of the sewage of the Listowel sewerage system.

After discussion, the plans were approved of, subject to the following provisos, on motion of Dr. Bryce, seconded by Dr. Kitchen :

1st. That the septic tanks of the system be extended, when necessary, from time to time, so that the capacity will always be equal to one day's sewage flow.

2nd. That the filter beds or other method for final precipitation of the sewage shall be of such area and construction, and be so conducted that the effluent therefrom shall be of a degree of purity satisfactory to the Provincial Board of Health.

3rd. That should any of the manufacturers disposing of factory wastes into the sewers of the town be found to discharge sewage of such a character as to place an unreasonable expenditure upon the town for purifying its sewage, it shall be a part of this approval that at any time the Provincial Board of Health directs the Town Council of Listowel to take any additional measures to purify its sewage, the Board reserves to itself the right to determine the means and extent of the same which any manufacturer must adopt to remove a definite amount of solids and deleterious matters from his sewage wastes before pouring them into the common sewers of the town.

4th. That the town shall adopt a Plumbing By-law similar in its provisions to that contained in Schedule "B" of the Public Health Act, or the Model Plumbing By-law issued by the Provincial Board in 1897.

5th. That the town must employ in the management of its sewage disposal works a competent engineer, to keep the same under supervision, and that he shall have direction of the workmen in charge.

(Signed) P. H. BRYCE,
Secretary of Provincial Board of Health.

Copy of Engineer's Report.

Listowel, 9th April, 1902.

To the Mayor and Council of the Town of Listowel :

Gentlemen,—As the disposal of the sewage is in Listowel a serious matter, the "separate" system of sewerage, which excludes the storm water, and thus keeps the quantity of sewage at the minimum, is best suited to the requirements of the town, more especially as the storm water can in any part of the town be conducted to the natural watercourses with but little expense.

The course of the sewer should be along the river valley to the right of the stream ; above Main street a ten-inch pipe will be sufficient, while a twelve-inch pipe will be necessary below that point ; these pipes running half full will carry off 400,000 gallons of sewage per 24 hours, or will provide, when running only half full, for twice the present population.

Manholes for purposes of inspection and maintenance will be required every 300 feet, and three automatic flush tanks to keep the sewer clean, should be located at proper points ; these flush tanks hold from 300 to 500 gallons of water, and are set to discharge at regular intervals, usually at from 6 to 24 hours, as occasion may demand.

Disposal of Sewage: As the Public Health Act will not permit the discharge of raw sewage into the river, some system of treatment for purification must be adopted.

There are several systems of sewage disposal in use, each of them applicable to certain conditions. I do not consider it necessary to burden this report with their several advantages and disadvantages, but think it sufficient to describe the system which I think best adapted to your needs : This is Bacterial Purification by means of septic tanks and filter beds. In this system the sewage is received in closed tanks holding from12 to 21 hours' discharge ; the sewage passes slowly through the tanks, the effluent being turned on to filter beds for further purification, the filtrate from the beds then passes directly to the river.

In the tanks the sewage is acted upon by bacteria called anaerobes, which thrive in the absence of air and light ; these bacteria liquify all the organic matter in suspension, and the liquid passes on ; the solids remaining are almost entirely inorganic matter, which settles in the bottom, and is very small in quantity. It will require to be removed probably once in six months.

Further purification is accomplished in the filter beds, where another species of bacteria carry on the work ; these bacteria are called aerobes, and depend for existence on light and air. These beds must be used intermittently, allowing time for the filling of the interstices with air between the doses of sewage. If used continuously the filters will become waterlogged and ineffective.

I would recommend that the disposal works be located near the crossing of the river by the Kincardine Branch R.R.; and that the works consist of two septic tanks holding about one day's flow of sewage, and two filter beds of about 1-10 acre area.

The following is an estimate of the costs :

Sewer from brewery to disposal works.................	$3,866
2 septic tanks, concrete, 40. ft x 12 1-2 ft. x 6 ft..........	978
2 filter beds, 40 ft. x 50 ft., 3 ft. deep gravel or coke....	780
Land for works and right of way.....................	300
	$5,924
Add for contingencies 15 per cent.....................	839
	$6,763

Should the Government experiments, in progress at Berlin, indicate that preliminary treatment of the manufacturing sewage is necessary before admission to the sewers, the advice of the Government bacteriologist should be taken as to whether he considers preliminary treatment necessary here. I am of opinion, however, that nothing of the sort will be required except in the case of the Gas Works, where the water used in washing the gas contains quantities of tar, and the woollen works, where the sewage contains a powerful anti-septic, which may have a detrimental effect on the action of the tank unless neutralized before discharging into the sewer.

I am, gentlemen, your obedient servant.

W. MAHLON DAVIS, C.E.

THE SOCIAL PHASE OF SMALLPOX AND VACCINATION.*

By P. H. Bryce, M.A., M.D.

Prof. Sedgwick, of Harvard, in his recent work defines public hygiene "as the science and the art of the conservation and promotion of the public health." Accepting this as a practical definition of the scope of public health, it is evident that we may very properly discuss the relation in which diseases, of which smallpox is the type, stand to the interests of society, whether as individuals in a social unit or community or as citizens of a nation which enacts laws for the government of its own people. Much argument may be had as to the extent to which individualism or communism in its exact sense should be the underlying principle in legislation ; but practical common sense and general experience, as seen in every-day business, in educational, municipal and religious affairs, teaches that what cannot be done so well by the individual alone, as by a number acting together for a common end, may properly come within the sphere of governmental and municipal action. The strength of this position may be pressed still further in any case where the action or inaction of one individual directly endangers the welfare or health of another. Such has been the subject of common action, even in those primitive communities, whether in past or present time, which have sacrificed a member of the tribe—even their choicest youth—to placate an offended deity, or who have put to death wendigoes or witches, supposed to exercise malign influences whether upon men or cattle. We may then properly conclude that in the instance of a contagious disease, and especially of smallpox, which to the most uneducated, as the western Indians, whose traditions tell of whole tribes destroyed by epidemics of it, is looked upon as so loathsome and terrible that armed men have been known to guard the banks of a stream to prevent men from an infected settlement crossing, the most primitive societies recognize that common action may properly be taken to avert what is or may become a general danger or calamity.

The postulating of such a principle for the action of society must seem to most people wholly unnecessary and commonplace in view of the facts illustrated by a hundred years of history ; and yet, we have only to read extracts from the daily press, from many particularist magazines, and, indeed, from many so-called scientific journals, to learn the truth of that Scripture: "Where there is no vision, the people perish ; but he that keepeth the law, happy is he," to find medical officers of even large Canadian cities assuming reactionary attitudes with regard to the duty of the individual and of the community in dealing with outbreaks of this disease—if the cases be mild—by means of vaccination and prompt and thorough quarantine.

However commonplace, it does seem necessary to recall a few facts culled from the pages of history. Dr. Brooke (1766 A.D.) says, in his General Practice of Physic : "Smallpox has been for ages, and continues to be, the terror and destroyer of a great part of mankind. . . . In the ordinary course and duration of human life scarce one in a thousand escapes the smallpox." Before this, indeed, Ben Jonson had written an epigram to smallpox beginning with :

"Envious and foul disease, could there not be
One beauty in an age, and free from thee?"

while at the beginning of the nineteenth century we are informed that 90 per cent. of all the inmates of hospitals for the blind in England were there on account of smallpox. Dr. George Bell, of Edinburgh, wrote in 1802 that the smallpox in Europe for more than 1,000 years has descended with undiminished violence from generation to generation, and every effort made hitherto to extirpate it has failed. Of epidemics in América we have statistics of Boston from 1721-1792, in which it is stated that there were seven epidemic years, during which the average population was 14,714, and the average number of cases 5,600, or 38 per cent.; while Simon says of it in the 15th century: "In Mexico it even surpassed the cruelties of conquest, suddenly smiting down 3,500,000 of population and leaving none to bury them."

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*Printed in Canadian Journal of Medicine and Surgery, Oct 1902.

Such was the monotony of history and statistics at a time when Jenner made his memorable discovery, imitating, except in the source of his virus, the practice introduced into England from Constantinople by Lady Mary Wortley Montagu of inoculation from a case of existing smallpox, and who wrote from Adrianople regarding the practice as early as 1717 A.D.

Of the effects of vaccination during epidemics, those in Montreal in 1885 may be given, wherein 30.08 per cent. of cases died in the unvaccinated and only 4.1 per cent in the vaccinated. The results during the recent epidemic in London, England, have told the same story. Thus, in the statistics for the week ending December 30th, 1901, we find that of 97 unvaccinated there were 60 per cent of deaths, while of cases up to ten years in vaccinated persons not one death occurred, and only two between ages of ten and twenty.

Such are only a few illustrations selected from an unlimited mass of materials showing what smallpox as an epidemic disease was, and would be to-day were its prevalence as great and our defences against it as limited as they were before 1796. One of the most pertinent questions which we may ask ourselves, however, is: "Granted all these facts, is it not true that in the Province of Quebec fatal epidemics of smallpox have not appeared since 1885, and that in Ontario the total deaths since 1882 have not much exceeded 200; and yet systematic vaccination has not been carried out by the people or the municipalities during the past fifteen years?"

The question has been posited thus clearly so that those doctrinaires who, in the matter of smallpox, would preach the expediency of a policy of *laissez faire* and of allowing outbreaks of the disease to be dealt with simply as ordinary diseases are by practising physicians, leaving the matter of quarantine and vaccination to the individual intelligence and sense of duty to the public, must accept the position either that such a course of action within their own experience or from the accredited evidence of history has suppressed outbreaks, has prevented an increase of the death-rate, has not produced destructive effects upon health as disfigurement of features or loss of eyesight, has not been disturbing to the public comfort and sense of security and has not been injurious to their own or the general commercial prosperity of any community. Are such prepared to accept and occupy such a position? But while they may not do this they may fall back upon another and say: "No, we are not prepared to go so far, since we admit that common municipal and governmental action has at times been necessary to suppress severe and fatal epidemics; but, nevertheless, there are diseases, and at present smallpox in America is such an one, which are so mild in their effects, so little fatal, and yet so difficult to control without great inconvenience and expense to the public that it were better to simply leave their management to the individual citizen and his physician. For the moment let us accept the position. It has been estimated that during a single year, 1900, there were in the United States at least 100,000 cases of smallpox; while in Ontario alone during a single year there were some 2,500 cases. The deaths in all were not greater than 1 per cent. in Ontario, and probably no more than this in the United States.

Taking that in Ontario as a type of the outbreaks, it may be stated that not much less, probably, than $500,000 has been spent by the municipalities and Government in preventing the spread of the disease. With regard to the number of persons liable to the disease, owing to their not being protected by vaccination—assuming, of course, for the moment, that successful vaccination in infancy is a protection up to ten years and very largely so up to twenty years—we may roughly estimate that of the population of Ontario, 2,182,947, the greater part of some 913,645 have been born since the fatal epidemic of 1885 in Montreal, during which vaccination was very general in Ontario. Since that year there have been a number of isolated outbreaks of smallpox in Ontario promptly stamped out ; but not until 1901 did the disease become general, that is, having numerous centres, and as a result no general vaccination has been practised for upwards of fifteen years until the present epidemic. Assuming a relatively large number of persons in Ontario to be revaccinated in the 1,200,000 over twenty years of age, and it is apparent that the situation as regards the number in both age classes liable to the disease is very large, and that the mortality rates which prevailed in London during the epidemic of last autumn and winter, or of the outbreak at present existing in New York, would have prevailed in Ontario had that type of disease been introduced, and had there been as many cases during 1901 and 1902 as there have been. There were in all some 3,500 cases in fifteen months, which, with an average mortality of 25 per cent., would have meant nearly 900 deaths. It has been already stated that at least $500,000 is estimated to have been spent by provincial and municipal authorities in stamping out the epidemic, and that most active and drastic measures both of isolation and vaccination were adopted. What the extent of the outbreak would have been had such measures not been taken cannot, of course, be definitely stated, but several instances will serve to give us some idea. Owing to the disease in 1901 not having been early diagnosed, and few measures of isolation and almost none of vaccination having been adopted, 550 cases occurred in settlements and camps in an area of 150 miles along the C.P.R. in a population not exceeding 10,000, between Sault Ste. Marie and Sudbury, within three months. In October, 1901, a case unfortunately diagnosed as chicken pox occurred in Dover Township, in Kent. For two months the disease had spread unchecked by any official action. Such, subsequently, for a time was not thorough. The total cases were nearly 100, not to mention many in neighboring townships arising from the Dover outbreak. In Osprey Township, in Simcoe County, in a most prosperous community, a mistaken diagnosis of the same kind in April, 1902, enabled the disease to get a start, and resulted, even with the most drastic methods subsequently, in 76 cases. In Burford Township, an old-settled and intelligent community, some 200 cases occurred in 1901 because the disease had first been called chicken-pox, and the local physicians had taken no steps to isolate cases or prevent the convalescents from attending schools and churches. The disease was only stamped out with difficulty, after thorough measures were adopted. Dozens of such examples, less notable simply because active measures for suppressing the disease were taken early, might be given ; while the 10,000 cases in the six months of 1885 in Montreal, most of which had occurred before active municipal measures for its suppression were adopted, illustrate the fact that, with a contagious disease present the average good sense of any community does not serve to prevent its spread, unless when crystallized into organized and systematic methods of action.

It has been, we think, fully demonstrated to what an extent the present epidemic of smallpox of a benign character, beginning in 1899, would have prevailed in Ontario had the views of the laissez faire school and of anti-vaccinationists been accepted ; and when they turn to statistics and point to the low mortality after all our trouble, we ask them are they prepared with us to adopt drastic measures of every necessary kind when the disease with a high death-rate does really make its appearance? If they do—and this is the position of many believers in vaccination, both amongst physicians and municipal officers—they will have to explain by what conceivable means they are going to discover when an epidemic, like that from Japan in 1900, which killed nearly 50 per cent. of its victims, is going to appear, though even its first case in Port Arthur was so mild that it was not diagnosed, or at what moment virulent smallpox may arrive in Toronto from some hidden source in the slums of New York or Boston.* Perhaps it is natural that we, viewing these matters from the official standpoint, should seem to disregard personal inconveniences and even municipal expenditures; but it would seem that there can be no *via media*, no position which, as with some other diseases, can be adopted without the assumption of a responsibility as regards loss of life, family misfortune and commercial disaster, which none who recognize what an epidemic of smallpox means would care to assume. Probably by none must the mental perspective be more accurately maintained than by the physician; and this can only be maintained by the frequent readjustment of the instrument to a proper focus from time to time. Our memories are proverbially short, and mental pictures grow dim with surprising rapidity; but we do well to remember that Nature is ever the same in her methods and her results, and if she seems at times to present herself in tranquil mood, as where the whole woodland is perfectly mirrored in the placid bosom of some northern lake, yet the time will speedily come when her rugged work must be done. He is, indeed, the wise mariner who looks well to staysails and masts, to keep his vessel afloat and return unscathed to the desired haven.

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*In May, 1900, an outbreak of smallpox occurred infecting many persons at different points between Winnipeg and Montreal, caused from exposure to a passenger from Australia *via* Japan to Vancouver, thence by C. P. R. The gentleman sickened on the train west of Winnipeg, was taken to the Winnipeg Hospital and died, as at first thought from purpura hemorrhagica. It proved to have been smallpox, and caused twenty-two cases and deaths in Winnipeg. Persons exposed on the train carried the disease to Eastern points. The first case at Port Arthur was mild and was not diagnosed, and resulted in the infection at that point and Fort William of fourteen persons and six deaths, at Arnprior of one person and one death, in Carleton Place of six persons and two deaths, in Montreal of six persons and two deaths, at Seine River of one case, at Sault Ste. Marie of one case and one death and at Wolfe Station of one person and one death.

SOME SCIENTIFIC AND PRACTICAL ASPECTS OF VACCINATION.*

By P. H. Bryce, M.A., M.D., Toronto.

Mr. President and Gentlemen of the Medical Society of the State of New York :

I have to express my appreciation of the honor conferred upon me through the invitation to address your society on a subject which, however old and hackneyed, becomes, in view of its present importance, one of extreme interest.

After a hundred years since Edward Jenner's discovery had been accepted in Europe, and by some of the more eminent physicians of America, we find a disease, which in the eighteenth and preceding centuries had its victims indifferently in the hovel and the palace, so little prevalent that until within the past three years the majority of living physicians in America and Canada had never seen a case of smallpox; and as it has happened the greater number of cases which have been seen on this continent recently have been so mild that we have to go back to the days of Sydenham, in the seventeenth, and Van Swieten, in the eighteenth century, to find a parallel for this anomalous type of the disease. It has not been, therefore, unnatural that to those inexperienced in the appearance of the disease, and even to those familiar with the type of the disease as it has appeared when introduced from Europe, much doubt has arisen as to whether or not the disease which, brought from Cuba in 1898, has spread so widely over the Southern, Western and Central States and Canada, has been true variola.

One supreme test of vaccination has enabled us, however, to prove conclusively its nature, since it has been so successfully combatted by that wonderful discovery of Dr. Edward Jenner, as the numerous outbreaks which from time to time have previously appeared since 1800. What he taught, in brief, was that by vaccination we introduce by inoculation a disease which causes a vesicle of a particular character on the teats of a cow or on the tender skin of the belly of a calf, the virus of which when inoculated into a person produces a vesicle of a peculiar character. We now know, what Jenner and other experimenters of his time, believed, from their experiments in variolation or inoculation with smallpox virus, that a similar vesicle can be produced through inoculating several calves in a series with virus from a smallpox patient, and that this smallpox virus thus modified produces in other calves, in man, in monkeys, and in guineapigs a vaccinia which protects against smallpox completely in practically all cases for ten years, in a large percentage for twenty years, and which, though decreasing, continues to protect against the severity of an attack of smallpox to a large degree throughout life. In the absence of any knowledge of the germ theory of disease, it is natural that Dr. Jenner and his associates should not have arrived at any clear idea of how this protection was produced, further than that it was the same as that caused by other eruptive maladies, whether in man or animals.

Not until Pasteur's discovery of the germs of anthrax and chicken cholera, and his success in producing immunity by the cultivation of the micro-organisms of these diseases, did it become possible to formulate any theory as to how the protection by inoculation with the germs of a disease was brought about. Without discussing modern experimental evidence regarding immunity, we have only to realize the organism of any bacterial disease as a simple cell, having its environment within the body, subject to variations, just as in nutrient media, and multiplying and completing its life-cycle in the body, obtaining its pabulum from the fluid tissues and their contained cells, and producing substances peculiar to itself, acting upon and being reacted upon by the normal tissue-cells, in order to understand that its pabulum may be exhausted as in a culture medium, that its products may become auto-toxines, and that they may stimulate in the tissue-cells of the body the production of compounds inimical to the further development of the micro-organism of the specific infection.

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*Read before the State Medical Society of New York, Jan, 27th, 1903.

We, therefore, very properly may conclude that as the bacillus of diphtheria grown outside the body produces its toxine, which, introduced into horses, produces the anti-toxine, whose quality and antidoting strength can be measured, so the variolous or vaccinal germ produces its toxine, which stimulates the tissue-cells to produce their anti-toxine.

That such is actually the case has been experimentally proved, especially by Beclere and Chambon, of Paris, who have shown that active vaccine lymph may be neutralized by adding to it in test-tubes the serum from vaccinated heifers, or from men, or monkeys recently having had variola. We have every reason, therefore, to conclude that variola is a bacterial disease, and that Copeman's, Klein's, and others' claims that they have isolated the micro-organism of smallpox or vaccinia are founded upon fact.

The progress of vaccinal immunity in calves has further been admirably illustrated by the experiments of Beclere, and Chambon, in which subcutaneous injections of active glycerinized lymph were made, and subsequently epidermal inoculations were made on succeeding days from the 3rd to the 7th. The effect on the vaccine vesicles when the scarifications were made after the fourth day, were (a) vesicles appearing sooner than in normal vaccination; (b) vesicles modified in external appearance, rapidly arrested or aborted in development; (c) lymph having little or no virulence when taken from vesicles after the fourth day. Such, in brief, is the basis upon which the immunity caused by vaccination rests; and it must be satisfactory to all who have followed the marvellous results of the biological study of infectious diseases carried on during the past quarter of a century. It is, however, a remarkable fact that while the practice of protective and curative inoculations in the instance of diphtheria have been generally accepted both by the profession and the public, there has grown up during the very period in which the experiments which form the groundwork of all our theories of immunity have been carried out, an opposition both to the theory and practice of vaccination against smallpox, which even in conservative England, which claims the honor of the great discovery of Dr. Jenner, resulted in 1898 in the introduction of the conscience clause in the Compulsory Vaccination Act.

Wherein, then, lies the origin of this opposition? Primarily, I believe it lies in the simple fact that vaccination laws are compulsory. We have, in fact, no other law compelling persons to subject themselves to inoculation with a disease at a time when they are in perfect health, and when, as a matter of fact, no cases of the disease may exist in their community, nor, indeed, in their country. In the second place, the fact exists that in an occasional case unfortunate results have followed the operation, giving some reason for the objections which have been raised. What moral grounds, then, can we have for our insistence upon the necessity for such legislation; and if such can be shown to have a basis in reason, what are the logical deductions to be drawn as to the moral duty laid upon the State which institutes such legislation?

With regard to the first question, we have several answers:—(1) That vaccination has during a century been the means of reducing the mortality from a disease, which previously caused one-tenth of all deaths in European countries, to the lowest of any of the infectious diseases which we have to combat in temperate climates. (2) That the theory of the immunity caused by it is based upon experimental evidence which has completely revolutionized the practice of medicine, and produced results in the instance of such diseases as anthrax, rinder-pest, plague, and diphtheria, which are comparable to that of vaccination itself. (3) That inasmuch as the infectiousness of smallpox is incomparably greater than that of any of these diseases, experience in every country has shown that, while sanitation, isolation, and disinfection, play important parts in the work of prevention, even the most complete sanitary organizations have failed again and again to eradicate the disease from a community without vaccination. (4) That we have the marvellous fact that vaccination is adequate to protect completely against the disease after exposure has taken place, even up to the fourth day, and of reducing the severity of the disease to a non-fatal issue in almost every instance where vaccination is concurrent with the smallpox.

If, then, we have such potent reasons for persisting in our demands for compulsory vaccination, we must be prepared to accept the fullest responsibility for the position taken, which must be that, if we insist on compulsion, we shall not, through indifference or neglect, allow anything to exist or take place by which any element of danger can enter into the results of the operation.

I am quite prepared, gentlemen, to admit that while any serious results which have ever been shown to follow the operation are in practice infinitesimal compared with the total number of operations, yet the secondary effects of the operation at times from the ethical standpoint have been such as to clearly inculpate either the producer, the operator, the patient, or two, or, indeed, all three together.

As regards the producer, we must realize that while bovine vaccine has been produced and used largely during the past twenty years in America, the methods adopted being in the hands only of private producers, would not be likely to be improved beyond the scientific knowledge of the biological theories, explaining the modes of its production. Not until bacteriology had made known to us the part played by staphylococci and streptococci in pyemia and septicemia, could we understand why the secondary infections were unnecessary and avoidable complications of vaccination, recognized, however, as to their existence, even by Jenner, who said, "That the most material indisposition, or at least that which is felt most sensibly, does not come primarily from the first action of the virus on the constitution, but that it often comes on if the pustules be left to chance as a secondary disease." Hence it was not uncommon, up to quite recent years, for lymph to be taken from vesicles on a second, or even third day, and for clamps to be used for extracting the largest amount of lymph possible from the vaccinifer. Within the last ten years, however, with the experimental work of Blaxall, Copeman, and others, all this has changed; and to-day we have producers everywhere supplying or endeavoring to supply a vaccine free from extraneous organisms. As usual, the very virtue of the method has become in some instances a defect, and it is found that at times the activity of the virus itself has disappeared. New producers have entered the field, widespread outbreaks have created unexpected demands for vaccine, and between inexperience and commercial necessities, the practice of vaccination has been injured by lymph at times of excessive virulence, and oftener by that having no protective value. It is, therefore, apparent that until all vaccine sent to the operator has been tested, and indeed standardized, as diphtheria anti-toxine, by experiments on persons and animals, we must feel that the ethical demands of the situation have not been altogether met. That it would make lymph more costly can be no valid reason for its not being done, and no State with a compulsory law can evade the responsibility for neglecting to demand of producers that all vaccine supplied be tested, or, failing to secure this, must supply adequate facilities for its production by qualified State officers. When we turn to the operator, or public or private vaccinator, we find that while the State licenses medical practitioners, there seems to have been everywhere on this continent a growing neglect on the part of medical colleges to either teach the theory or illustrate the practice of vaccination. We find lymph which has been stored for weeks in a drug store used by the practitioner as if it were an inert mineral drug, incapable of change ; and while, in a surgical operation of another kind, the practitioner may carry out aseptic precautions to an almost absurd extent, he will invade the uncleansed epidermis with, perchance, an unclean scalpel, and, after scarification, leave the unprotected wound to its fate, with an unthinking disregard of whether its course may be normal or a dangerous secondary infection supervene. In all this the personal elements as regards scientific knowledge and personal responsibility from the ethical standpoint are points which, perhaps, it would be too much to make the State responsible for ; but if the credit of vaccination is to be lessened or a single person injured by the operation, then it is clearly the duty of the State to allow such compulsory work to be performed only by responsible, trained, public vaccinators, and to establish heavy penalties, as is done in Germany, for any unqualified person performing the operation, or for proved carelessness on the part of a public vaccinator.

It is apparent that to institute such a system legislation of a kind similar to that of England and Germany would be essential. In England, and especially in Germany, compulsory vaccination is accompanied by provisions for the production of vaccine by State establishments, where the responsibility for the production of tested lymph properly rests, and whence lymph is supplied to qualified public vaccinators, appointed by the municipalities. The system further provides for the regular and systematic vaccination of infants, and of vaccination on entrance to the schools, and to the army and navy. Such desiderata are making themselves felt more and more on this continent, where increasing urban populations and the facilities for the transmission of infection through the extending travel by railways, are yearly becoming greater.

With regard to the individual responsibility for unfortunate results of the operation, but little need be said. If the vaccinator does not warn the patient of the precautions to be taken we may expect that the latter too frequently, through ignorance, will be lacking in a knowledge of the care necessary to protect himself. He ought to be taught to know that he is inoculated with a disease, and that for the short time required he must consider himself a patient. In the 1900 report of the Medical Officer in charge of the vaccinations at the National Vaccine Establishment, London, we are informed that out of 1,892 primary vaccinations, eleven on subsequent inspection showed some abnormal course, most of which consisted of "sore arm," caused by domestic maltreatment.

In view of the distribution by producers of lymph through the journals of this country, and through advertising circulars within the past three years, of statements regarding vaccination, which at times have been at variance with the authoritative teaching on the subject, it may not be ill-timed to refer briefly to the question of what constitutes a normal lymph and a normal vaccination. It must be remembered that for years we have looked upon a good vaccine as one which by its more rapid evolution will within eight days have developed so complete a vesicle that it will serve to protect a person inoculated up to the fourth day after an exposure to smallpox, the incubation period of which is from twelve to fourteen days. We learn, from report after report of the National Vaccine Establishments in England, Germany, and France, that the vesicle on the calf is mature within ninety-six to one hundred and twenty hours after inoculation. So fixed for many years was the period of maturation of the vesicle in man, that the compulsory laws of England required all children to be brought on the eighth day for examination of the pock. According to Copeman, of the London National Establishment, glycerinated as well as crude lymph, if normal, will have produced by the seventh day a vesicle five or six mm. in breadth, with a glistening, translucent margin of a nacreous or pearly appearance, with the pale-red areola, the rest of the surface presenting a more opalescent, bluish-white appearance, while the patient suffers from malaise, with some inflammatory fever, and involvement of the axillary glands. From this pearly margin our old teachers took the lymph on the eighth day for arm-to-arm vaccination. With this picture so constant for a hundred years, it is astonishing that we should recently have had new teachers informing us that glycerinated lymph produced normal vaccination when a vesicle had matured on the twelfth day, without, as many of us know, presenting the pearly border and characteristic vesicle which we have been taught to look for. It is apparent that if we were to accept this new teaching, the protective inoculation after an exposure to smallpox would become impossible. Fortunately, this new doctrine was short-lived ; and, personally, I have been able to demonstrate even to the satisfaction of producers, that a normal lymph, even though it may have had to overcome some slight immunity, was able to produce in a patient so vaccinated an eighth day vesicle of a quite typical character. Such lymphs, we have, unfortunately, had good reason to know, have not only not protected against another vaccine, but have not protected against the mild type of smallpox, which has so generally prevailed. It has, hence, become essential to the maintenance of the credit of vaccination that the public officials as well as the profession should not only have perfectly clear ideas as to what a normal vaccination is, but that they further be placed in such a position in their several States and cities as to insist upon the use of only such vaccines as will produce normal vesicles and effective immunity.

One of the results of these new theories has been to cast discredit on the very great advances which have been made through the introduction of aseptic glycerinated lymph. Articles everywhere have been appearing in the medical press condemning unsparingly glycerinated lymph ; and, from the standpoint of the results above indicated, with some reason. But it is apparent that when we can obtain statistical results collected from hundreds of public vaccinators under an organized system, where, as in England, in the year ending March 31st, 1902, lymph for 974,595 vaccinations had been sent out from the National Vaccine Establishments, and where for the quarter ending December 31st, 1901, 264,044 vaccinations showed a success of 97.9 per cent., and an insertion success of 93 per cent., we have a basis of fact which should wholly disabuse our minds of the idea that glycerinated lymph is a failure.

The actual figures published are :

	Cases.	Case Success per cent.	Insertion Success per cent.
Primary vaccinations	126,209	98.6	94.0
Re-vaccinations	134,835	97.2	92.0

Another theory which has likewise had its rise in these modern days of "sweetness and light" is that one scarification is sufficient for protective purposes. Contrary, perhaps, to what the theory of immunization might lead us to conclude, viz., that so long as the system becomes inoculated, it does not make any difference how the lymph was introduced, whether by one or five scarifications, we have the statistics of more than half a century proving absolutely that it does make a difference whether much or little lymph be introduced. We have long been accustomed to say that a well-pitted person will never take smallpox again; and we presume this is true. We say that a child which has suffered from a severe type of measles or scarlet fever is absolutely immune against another attack; and in practice this is true. We surely, then, are justified in saying that, just as the very slight protection produced by a twelfth-day vaccine has not established an immunity even for a month against an active vaccine, so a single scarification does not allow the same absorption at one time, as several would, of a virus whose activity is to overcome the vital resistance of the tissue cells, and will not, therefore, call up the same degree the vital energy in these cells to produce those anti-bodies, whatever their nature, upon which we now depend to explain the immunity.

The table of Mr. Manson, surgeon to the London Smallpox Hospital from 1836-67, of 13,755 cases of smallpox, seems conclusive on this point:

13,755 cases of Small-pox classified according to the vaccination mark on each.	Percentage of deaths.	
	1835-1851 (3,094 cases).	1852-1867 (10,061 cases).
Stated to have been vaccinated, but no cicatrix	21.7	39.4
Having 1 vaccine cicatrix	7.6	13.8
" 2 " "	4.3	7.7
" 3 " "	1.8	3.0
" 4 " "	0.7	0.9
Unvaccinated cases....	35.5	34.9

Such facts seem to be conclusive, and fortunately they do coincide with most of the knowledge we have concerning this wonderful fact of immunity against eruptive diseases, either through contagion or experimental inoculation.

It is apparent, gentlemen, that the few practical questions I have touched upon only serve to illustrate to what lengths the subject would lead us, if we attempted to do it justice. It is, however, the practical side to which public officers of health have constantly to direct their attention; and it is apparent that we on this continent, with our democratic methods, have been hitherto greatly limited in our powers to either control the quality of vaccines which have been supplied, or to produce in State establishments products which would fulfil the requirements.

Within the last year, however, official opinion has been crystallizing, and its conclusions, briefly stated, would seem to be: (1) That official supervision of the products of vaccine establishments by either State or Federal officers is imperatively demanded; or (2) that the production in State or Federal vaccine establishments of adequate supplies of vaccine of established quality, to be sent out free or at cost to municipalities, has become a necessity.

It is not necessary here to enter into a discussion of which scheme is preferable; since, while Government production in Germany, England, etc., has proved itself a success, it cannot be forgotten that in some respects our democratic methods do not always conduce to that permanency of the civil service and freedom from political complications which are necessary to efficient performance of scientific work. On the other hand, the unlimited capital and keen competition of the large commercial houses supply in many ways facilities for the production of standard articles, and their maintenance at a high standard of excellence, which, perhaps, few individual States could attain to. Personally, I am convinced, however, that no matter which scheme is adopted, there is demanded before everything else adequate legislation whereby from year to year qualified public vaccinators must be appointed in every municipality, who shall be empowered to vaccinate systematically all children born in any year, and that through the responsibility laid upon them, and the routine methods established, such men will become experts in the art, and will gradually obtain such a store of information as will prevent the use of any except standard vaccine, and by the care exercised be able to anticipate and prevent those accidents which we have already referred to as seriously injuring the credit of this greatest triumph of modern medicine.

Cases and Deaths from Contagious Diseases from 675 municipalities.

(Annual Returns for 1902.)

Smallpox.		Scarlatina.		Diphtheria.		Typhoid.	
Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
2,797	12	3,452	290	2,696	408	1,542	242

Total Deaths from Contagious Diseases and other causes by months for the year 1902. Average Population reporting, 90%.

Date.	Scarlet Fever	Diphtheria.	Measles	Whooping Cough.	Typhoid Fever.	Tuberculosis.	All Causes.
Jan....	28	48	21	7	31	169	2023
Feby.	38	34	21	16	25	177	2241
March......... ...	42	47	18	12	14	232	2479
April...............	13	36	15	10	24	233	2490
May............ ...	20	30	13	13	18	184	2201
June	35	20	10	16	16	207	1844
July	5	19	2	7	13	152	2015
Aug.	10	18	0	21	26	172	1912
Sept.	11	25	0	9	52	173	1951
Oct.............	18	60	1	8	54	170	2028
Nov.	21	45	3	11	34	147	1874
Dec.	41	62	2	14	56	148	2150
Total..	282	444	106	144	363	2,164	25,208

THE SEWAGE DISPOSAL OF SUBURBAN HOUSES AND PUBLIC INSTITUTIONS.

By Dr. P. H. Bryce, M.A., M.D., Secretary.*

To the President and Members of the Ontario Architects' Association:

Gentlemen: It gives me pleasure in complying with your invitation to prepare a paper on some sanitary problem connected with your work, to present a paper on the title indicated, as being of extreme importance, connected as it is directly with the problem of "Pure Air in Houses," which I discussed before you last year.

As we are well aware, there is a more or less marked difference in the air of country places and of towns and cities, indicated by a small excess of carbonic acid (CO_2) in the latter, and the absence of ozone, or oxygen in a nascent condition, due to the excessive presence in towns and cities of organic matters on the surface, in houses, lanes, manure heaps, drains, and so on, constantly undergoing decay or reduction to simple compounds by the action of various living organisms, especially bacteria, which utilized oxygen in their biological processes. Sometimes they find this oxygen in the organic compound itself, especially in the azotic or nitrogenous compounds, but also in the carbon compounds of a starchy character; in other, and under ordinary circumstances, they utilize the oxygen free in the air. As will be supposed, there are different species or classes of this minute form of largely vegetable life, some of which do not thrive in free oxygen and air, and some forms which live within the bodies of animals and external to them in free air as well.

To the first class Pasteur long ago gave the name an-aerobes, or microbes living apart from air, and the second he called aerobes, or those which require free oxygen for their development.

The two classes have properties differing more or less from one another, one especially peculiar to an-aerobes being the liquefying of organic compounds by growing into these, and really dissociating their solids, as, for instance, gelatine, forming, of course, by-products during the process, both of gaseous and liquid character. The constitution of these chemical compounds varies; that of the gases being principally CO_2, H_2O, H_2S, and many highly organized volatile compounds, such as those given off by the breath of man and animals, those from the many foods and fruits, which develop during their mellowing and decay, and especially the extremely unpleasant emanations given off from putrefying meat, fish, and the solid wastes, which pass off to the sewers as excreta, and kitchen and house wastes of every sort. It is a fortunate fact that the products of aerobic decomposiion are less disagreeable and injurious than those from an an-aerobic decay, since such are those which are most constantly exposed to air from surface decomposition of outside matter everywhere. With these preliminary rmarks, it will be easy to see something of the nature of the problem to be dealt with in disposing, safely and conveniently, of the house wastes which go by the name of sewage, or those matters which are conveyed by water into underground pipes or sewers.

It is the experience of every local health officer, and a source of constant difficulty to the Provincial Board of Health, that in those towns where a sewerage system does not exist, and in many houses in the suburbs of towns, even where such systems are, in rural districts, and in the large temporary summer resorts, hotels and cottages, the problem of what to do with excretal matters, both animal and vegetable, has been everywhere, if not difficult, yet the most constant one which the Local Boards have to deal with in the matter of nuisances, and which, in many cases, proves the most constant danger to the household immediately interested, and where streams or lakes are polluted, not unfrequently has become the occasion of some sudden and serious outbreak of typhoid fever or diarrhoeal disease. The fact that 253 examinations of water were made during the past season by the Provincial Halth laboratory shows that the causal relationship beween polluted water and typhoid and diarrhoea is well recognized, and general observation, as well as laboratory work, is quite agreed as to the direct connection between such pollution and some accumulation of decomposits of animal or vegetable matter. Privy vaults, deep pits, or cesspools, constant contamination of the area around the house pump with kitchen washings, and slops of every kind, hotel stables and barnyards, soakage from slaughter houses, the wastes from cheese factories and creameries, and the heaps of refuse from canning factories, and indeed every kind of manufactory in which organic products are used, may become direct means of pollution to wells and sources of public water, and many are, moreover, the cause of serious injury to health from their creating effluvium instances.

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* Paper read at the annual convention of the Ontario Architects' Association.

Now, perhaps, gentlemen, as it may be only occasionally that as architects you are called upon to deal with more than one of these sources of ill-health, viz.: this one of the disposal of house sewage, including excreta, kitchen and chamber wastes, in places where there are no public sewers, it is most essential than some general principles should be laid down and acted upon, with a view to the safe, economical and aesthetic method of disposing of such organic wastes.

Probably every one here accepts the theory that in the economy of nature nothing can be lost, or that matter is indestructible, and perhaps all will, in a general way, agree that whatever is yielded by the soil, as, for instance, the potash, phosphates, ammonia, and so on, which are contained in the grains and other fruits of the earth, should be given back to Mother Earth for her goodness to us. So, in spite of man's foolish waste and ignorance, they ultimately are returned to her, but at an enormous cost of time and energy. Carried to the sea, sewage will form deposits ultimately forming new land, or in solution will become the food of microscopic vegetable forms of many species of the deeper ocean planthon, and of the larger plants of the ocean littoral, which in turn become the food of the microscopic infusoria, and finally the food of fishes, molluscs, and other sea animals, and so is brought back finally as food to man. Were we intelligent and careful, we would see to it that not a single pound of organic waste matter is allowed to decompose out of its place: in other words, to so act as to return to the earth every ounce of C, H, O and N, which taken from the humus or upper layer of soil, is year by year being used up by cultivation, and must be returned there, if fertility of the soil is to be maintained.

As, however, it is found in practice in most parts of this country that there is a lack of appreciation of the manureal value of such materials, and that the adoption of what is known as the dry-earth system in houses and institutions has not proved free from objection, owing to neglect to supervise it carefully, owing to its cumbersomeness, and as, moreover, it does not do away with either the need for water pipes, and a supply of water being laid on in the better houses, or of the need for disposing of the kitchen and chamber wastes, in any case it is evident that the growing appreciation of modern conveniences in houses is demanding some systematic method for dealing with all house wastes, whether for kitchen or closet by the water-carriage system.

I propose, therefore, to indicate how in practice such a system may be established, at once efficient and economical. In the Annual Report of the Provincial Board of Health for 1898 a chapter is devoted to "The Biological Principles Involved in the Purification of Sewage," which to those interested will be found to contain a very full discussion of the scientific principles of this whole matter. There will be found a table giving the average analysis of town sewage. While probably less concentrated than the sewage of a single house, since it would contain water from factories, from sub-soil drainage, and so on, yet it will very well serve as an illustration of the contents of sewage. It is as follows:

(1) Solid matters in suspension—		
(a) Organic	20	grains per gallon.
(b) Mineral	10	" "
	—	
Total	30	" "
(2) Solid matter in solution—		
(a) Organic	20	grains per gallon.
(b) Mineral	50	" "
	—	
Total	70	" "

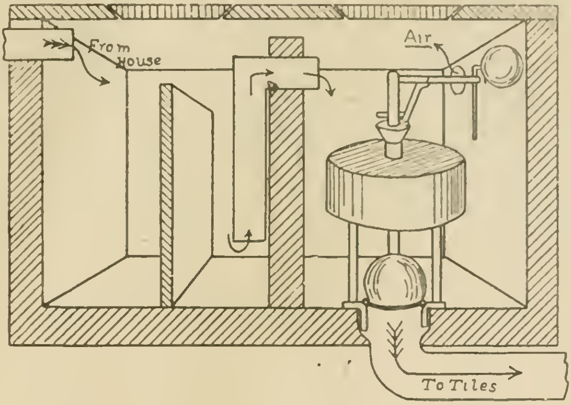
Or expressed in parts to 1,000,000 such a sewage would yield:

Total solids.	Solids in suspension.	Chlorine.	Free ammonia.	Albumenoid ammonia.
1,428.0 parts	428 0 parts	120.0	50.0 parts	10.0 parts

Assuming what is in experience ample, 20 gallons per head per diem of sewage, it will appear that for an ordinary dwelling, with 10 inmates, with a water supply laid on, there will have to be disposed of daily 200 gallons. By reference to the analysis, it is clear that half the organic matter, or that in suspension, could easily be removed by any crude filtering method, as by a screen, a grit chamber, or even by passing over coke or some readily destroyed material, should it become clogged.

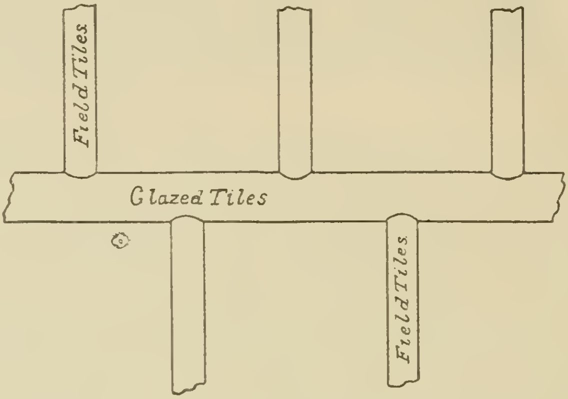
Assuming, however, that all the materials are carried to a common receptacle or tank at the end of the house sewer, there will be deposited daily 8,000 grains of organic matter, whether suspended or in solution, and 12,000 grains of mineral matter, or altogether some 3 pounds, of which two-fifths is organic, or is capable of undergoing decomposition, most of which will gradually be carried away when dissolved in the 200 gallons of water daily passing into the receptacle, the balance of carbon gradually being deposited in the tank. Of the mineral matter 50 parts are in solution, as potash, lime and other salts, which will likewise be carried away in the water. It thus appears that some 100 grains of insoluble mineral matter will deposit in the tank daily, with small amounts of carbon, or in 365 days for such a household not more than 10 pounds of mineral matters will have accumulated. That such is true may readily be proved by anyone caring to make the experiment, as I have done, that such a tank at the end of a year has not had a total deposit of solid matter, greater than can be held in a half-bushel measure. If the balance, then, after decomposition, is capable of being carried along with the 200 gallons of water daily, it is clear that nearly all of it is capable, like any other soluble material, of soaking away into the soil with the water, if the conditions are favorable.

I have had drawn up for your inspection the diagram of a tank, which is intended to deal with such materials in a way to give the organic matter an opportunity to decompose, the water carrying the soluble materials being gradually removed from the decomposing tank, which we may call the septic tank—the word septic meaning putrid or decomposing—to a second tank, whence it may be discharged by a simple apparatus, at such intervals as may be found practical to produce the best results. The question then arises: In what manner can we dispose of this organic matter in solution, conveniently and in such a way as will not create a surface nuisance, or a pollution of ground water? Let us assume that by a series of sub-surface tiles, laid in a proper manner, we can distribute the 200 gallons over an equal number of feet of surface. It is plain that each square foot would receive 1 gallon of water daily. As soils vary in their capacity for water, from a coarse sand which will hold in its interstices not more than 25 per cent. of its volume of water, to a tenacious clay, which holds 75 per cent. of its own volume of water, it is apparent that if one gallon of water were poured on the surface of a cubic foot of dry soil, there would not be any water leaking away from the bottom of even a coarse sand, since a cubic foot of water equals 6.25 gallons; so that it requires 1½ gallons to be poured on such foot of dry sand before it begins to drain away from the bottom. A dry clay would hold three times as much before it began to leak. In practice it will be seen that two four-inch tiles, laid side by side, would distribute such water fairly well over the surface of a cubic foot of earth; and also that the water contained in them soaking out of the open joints and pores of the tiles, would rapidly dispose of the small amount of water received by each tile daily. In practice it is found that in any ordinary porous sandy soil or sandy loam, tiles filled twice daily will rapidly dispose of the charge of soluble sewage poured into them; and, lifting up tiles after several years' use, I have found them lined only with a fine stain of black carbon, the volume of the tile not being materially lessened. I have further found that even heavy clay soils, with an occasional underdrain, have been quite adequate to dispose of the amount of sewage poured into them from an institution of 125 inmates.



It may be proper now to briefly describe the method of construction of such a system of tanks and sub-surface tiles. As in any system of house sewerage, it is convenient to arrange all the fixtures so as to discharge into one soil pipe. These being brought out beneath the ground floor through the foundation, or, if the house be on a hillside, it may occasionally be possible to bring them out under the cellar floor, so that the washtubs there may be discharged into them—if this unsanitary place for the laundry be adopted —the soil-pipe will be led to the top of a tank made of brick and cement in a manner similar to that shown in the diagram. If most convenient, this tank can be built directly against the house to save iron pipe, and to prevent its appearance on the lawn, since, as will be seen in a moment, it is necessary that the discharge pipe of the tank on level ground be not more than a foot beneath the surface. The capacity of this tank in the case we are discussing will be such as to hold in each compartment 100 gallons, to be discharged twice daily. It will be seen, therefore, that a compartment 2x3x3 feet will nicely hold 100 gallons, or a tank of interior measurement, 4 feet long by 3 wide and 3 deep, is adequate for two compartments, each holding 100 gallons.

The arrangement of the interior of the tank is shown in the diagram. As in all sewage tanks, the plan is adopted of having several divisions, the sewage becoming less dense as it passes from one to the other, thereby aiding to make that discharged from the valve chamber as thoroughly liquid as possible.



It will be seen that from compartment No. 1 to No. 2 the fluids are drawn off by an overflow pipe from about midway beneath the surface, since at the bottom will be found sediment, while the whole surface is covered with the decomposing matter, which appears to the eye a solid mass, but is really the organic material kept floating by the contained gases of decomposition. The liquids which pass over, of course, contain a large amount of organic matter in solution, being composed especially of ammonia (NH3) and carbonic acid (CO2), combined as ammonium carbonate with the sulphur compounds as ammonium sulphide. These are held in the second compartment until 100 gallons have accumulated, at which moment the flush valve operates automatically, and discharges in a minute or two the contents of the tank into the sub-surface tiles. It is apparent that the size of the tanks may be made such as to deal with 1,000 gallons quite as readily as with a 100.

The sewage thus discharged must, it is evident, be carried to tiles so laid that each tile will get its own share of sewage, and no more. It is apparent that with a rapid discharge the tiles laid on an exact level will each receive this amount, if together they hold exactly 100 gallons, provided the air which is in them be displaced. It is found in practice that in a loose soil the air from tiles laid near the surface readily gives place to the water, if discharged under the head in the tank. Where the soil is level, as of a lawn or garden, it is apparent that the matter is a simple one. If on a slope it is equally apparent that some careful detail work will be necessary in order that the tiles may, at the same time, be kept at the same depth beneath the surface, and also receive each its own share of sewage. To complete the description of the tank, it is apparent that as some gases, in excess of what are in solution, may be given off into the space over the sewage, it will be necessary to prevent them from accumulating, and forcing themselves through the cover of the tank. This is obtained by making the cover of rough boards, and if thought proper, they may again be covered with earth and sod. The gases, if any pass outward, will be absorbed by the soil. In addition to this, however, it is necessary to provide for the ventilation of the tank. This is done by a 4-inch goose-neck leading from the distal end of the tank, which admits cold fresh air, and thus will displace the warm gases of decomposition, which are carried up through the soil pipe to be discharged above the roof, as in ordinary house plumbing in cities where the separate sewerage system is in operation. It may be asked, what ultimately becomes of the organic matter carried away in solution? In reply I would say that through the action of the microbes of the soil the ammonia salts are rapidly nitrified—that is, are changed into nitrates or nitric acid, which at once combines with the lime and potash salts of the soil, and thus has become a neutral salt in a condition to act as plant food for the grass or vegetables growing above it.

The following table by W. D. Scott Moncrieff, from the Ashstead, England, experiments, 1895, illustrates the change:

Effluent from cultivation tank.

Chlorine.	Free N. H. 3.		N. Oxygen Consumed.	Nitric Nitrogen.	Total Oxidized N.	Total N. of all kinds.
9.0	12.5	10.3	9,843	0.12	0.12	12.46

From final filter tray after complete nitrification.

7.5	0.25	0 2	0 58	9.0	9.0	0.6

As the tank arrangement from which these experiments are taken was essentially a tank of this kind, except that, instead of the microbes of the earth to do the work, Moncrieff had arranged a series of artificial filters, holding pieces of coke, over which the sewage from the septic tank flowed, by which means the liquids for analysis could be obtained, there is nothing different in principle to the system we are discussing.

Little more need be said, I think, to make it clear that in these results of the study of biological processes, which convert organic matter back to its original constituents, we have not only a practical lesson of how to apply science to our every day needs and convenience, but we may also see how economical is Nature, and how wholly wise in her operations if she does not have man attempting, in his ignorance, to violate some of her primary laws. To me it daily seems more true, the more that I try to comprehend the meaning of the processes of Nature in this fine old world of ours :

> "That nothing walks with aimless feet,
> That not one life shall be destroyed,
> Or cast as rubbish to the void.
> When God hath made the pile complete."

PART III.

ANNUAL REPORTS OF LOCAL BOARDS OF HEALTH.

REMARKS ON THE REPORTS OF THE LOCAL BOARDS OF HEALTH

There have been received up to date the reports of 675 municipalities, and of this number only 122 Medical Officers of Health have forwarded their reports upon the sanitary condition of their several municipalities.

The return of cases and deaths from contagious diseases in the 675 municipalities is given in table A, page 172; but from the statements of the several clerks it is quite apparent that the number of reported cases is much smaller than the actual number which have occurred, there being in many of the rural municipalities a lack of care on the part of both physicians and householders in notifying the local authorities. That such is the case is quite evident from the discrepancy which occurs between the number of notified cases and deaths under the group "Tuberculosis"; the fault is doubtless in a large measure due to the neglect of the Local Boards to furnish both medical men and school teachers with printed forms for this purpose, only 30 per cent. of the municipalities reporting stating that the system is in operation. If Medical Officers of Health would see to it that the law is complied with in this regard, our statistics will be of greater value, and the public receive better protection, since in 65 per cent. of the municipalities systematic isolation of these diseases is now carried out, and with better notification there will necessarily follow a quarantining of many cases that heretofore have been a danger to the communities in which they live. The notification is the actual forerunner of systematic isolation, and both are of equal importance.

Perhaps in connection with this important question of notification, and one which must receive the serious consideration of Boards of Health generally, is the necessity which exists for isolation hospitals for the care of infectious diseases. At present something less than 10 per cent. of municipalities have any provision whatever for cases of scarlet fever, diphtheria, or smallpox, and none whatever have any accommodation for the quarantining of exposed persons. To wait until the necessity arises seems to be the principle which actuates Local Boards. This temporizing policy can only result disastrously. Indeed, this year several examples might be instanced where, although repeatedly warned by the Medical Health Officer to prepare a building before an outbreak has happened, large numbers of houses have been placarded, to the great injury of the trade of the place, and the outbreak has been nearly over before the isolation hospital has been in running order. A number of the towns and townships have very wisely provided themselves with the double-walled tents for this purpose, and for small places and rural districts they offer an economical and efficient means of isolating either the cases or suspects. Their portability is another advantage in the case of townships. The Isolation Hospital erected by the City of Ottawa for the treatment of cases of diphtheria and scarlet fever is a valuable addition to this class of institutions, and cannot fail to be a means of preventing the spread of these diseases in the capital. Both in internal arrangement and external appearance it ranks as one of the best in the Dominion, and the Local Board of Health is to be congratulated on its completion.

It is very gratifying to notice the increase in the number of municipalities where disinfection after contagious diseases is carried out under the supervision either of the Medical Health Officer or the sanitary inspector That in more than half the municipalities this important measure is carried on systematically is of itself a guarantee that the spread of these diseases has been materially lessened. To still further lessen their spread, it is urged upon all Local Boards of Health that they provide each medical practitioner practising within their several municipalities with blank forms on which to report such cases, in conformity with section 17 of schedule B of the Public Health Act, and it is most important that both Medical Health Officers, and Secretaries of Boards, see that the law is carried out in regard to this most important matter. In their annual reports many medical officers state that they "have reason to believe that considerable laxity exists regarding the reporting of infectious diseases."

Apart from the widespread outbreak of smallpox, which has been of a severer type than in former years, there have been no very serious epidemics. The type of scarlet fever which prevailed during the first three-quarters of the year, was extremely mild, but in many instances became very malignant during the last three months. The reports which continue to be received point to the fact that its malignancy is rather increasing than diminishing.

There have been reported outbreaks of mumps, measles, and whooping cough, but with the exception of that in the Township of North Oxford there is but little to note. In this township the Medical Health Officer reports that there were hundreds of cases of measles of a severe type, many adults being attacked, and "almost everybody who was not immune took the disease, which in many cases was complicated with bronchitis or pneumonia."

A pleasing feature of the reports is the decrease in most municipalities of enteric fever, and in all of diphtheria. The first was marked by a mildness in type, and the latter, by the general use of antitoxin in both as a curative and a prophylactic measure. The Town of Port Arthur reports 209 cases of enteric fever, with 11 deaths ; but it is only fair to state that a number of these cases, no doubt, came from the surrounding district for treatment in the hospital, thus reducing the total number among the townspeople. Another place where the disease was very prevalent was Sault Ste. Marie. The number of cases was very large, but in the absence of definite information we can say nothing. A report was made on the condition of affairs in the early fall by the Inspector of this Board, who attributed the outbreak to pollution of the wells and springs by surface drainage.

During the year there has been some progress made in regard to notification of and disinfection after cases of tuberculosis, and a number of the Medical Health Officers have recommended action along these lines, and it is apparent that the time is not far distant when such wise measures will become general, and as much or greater care will be taken to notify, isolate, and fumigate in this diseases as in any other of the group.

The most important preventative measure which Local Boards of Health have overlooked to enforce, through their municipal councils, and on the neglect of which has cost many a municipality thousands of dollars during the past three years, is that regarding vaccination. The situation can be best illustrated by the following extracts from the Medical Health Officers' reports.

"I find very few of the inhabitants under 25 years old who have been vaccinated."

"No general vaccination for some years."

"The law of Ontario which requires vaccination of all children attending school has remained a dead letter."

"Vaccination although made obligatory on all residing in this municipality is, I am sorry to say, almost universally ignored."

and in reply to the question, "are new school children vaccinated," not 10 per cent. of the reports reply in the affirmative. There is, then, but little wonder that smallpox has made so much progress in some sections of the Province, and in ivew of this serious neglect to protect themselves, municipal authorities have in some instances had heavy accounts to pay.

While the interest taken in the proper methods to be adopted in the case of tuberculosis, whereby its spread may be prevented, is very general, as yet there is no systematic notification, and only in a few instances have Local Boards taken any precautionary measures. The Town of Petrolea carries out disinfection in cases of tuberculosis, under supervision of an officer of the Board.

The adoption of some simple rules which would be applicable in most cases would be of material assistance in preventing its spread. These rules should be made applicable to workshops, factories, and schools, if the work is to be done thoroughly.

The reports of the Medical Officers of the rural districts speak very favorably of the marked improvement in matters of domestic sanitation, as they concern the farm house and its surroundings. It is a subject well worthy the attention of every Local Board of Health, and one, once instituted, cannot fail to be appreciated by all (a hint from the beneficial results to personal health). The following are a few extracts on the subject :

M.H.O., Tp Derby :—"The voluntary compliance by the public to the matters of domestic sanitation is a subject of congratulation."

M.H.O., Etobicoke :—"I am pleased to state that the people are every year paying more attention to the sanitary condition of their premises, and a better condition of the public health is the result."

M H.O., Antrim :—"For some years our board has given energetic attention to the sanitary condition of the township and I am pleased to say it is meeting with very satisfactory results indeed."

What these townships are doing and have done every similar Board can do, and should do at once.

Two very important matters yet remain to be touched upon, viz., the inspection of dairy cows and the licensing and inspection of slaughter houses. From the returns received it is very evident that some municipalities pay but little attention to either. The importance of agriculture both to the dairyman himself and the general public is very great and far-reaching, and it should be the aim of Local Boards of Health to maintain the standard, as high as possible, especially in view of the fact that the industry has reached such a degree of importance in the Province. The subject of slaughter-house inspection is only secondary in importance, but can the more readily be handled on account of the small number of each in a municipality.

The reports of the Medical Health Officers of the towns of the Province show that progress is being made in sanitation generally, and it is particularly gratifying to notice that in many instances these officers anticipate the public wants by suggesting either the introduction of waterworks, the establishment of sewerage systems, or the erecting of isolation hospitals. Others, again, draw attention to the need for a scavenger system.

As the reports of the cities of the Province are published in detail, no reference need be made thereto.

The general outlook is most satisfactory, from a sanitary standpoint. There is every evidence that the public is appreciating the need for sanitary reforms, as provided for in the Public Health Act, and year by year they are bettering the conditions of both our rural and urban districts.

BRANTFORD.

Report of the Medical Health Officer.

Brantford, Nov. 1, 1902.

To the Chairman and Members of the Local Board of Health :

Gentlemen,—I herein submit to you a report of the Sanitary Department for the year ending October 31st, 1902 :

Mortuary Statistics. The number of deaths, exclusive of still births, recorded for the period of this report was 245, which in a population of 17,021 gives a mortality rate of 14.33 per thousand.

Among the causes of death we find : Typhoid, 4 ; diphtheria, 12 ; tuberculosis, 36 ; pneumonia, 24 ; meningitis, 7 ; cholera infantum, 4 ; all other causes, 158.

It was also noted that regarding ages of death, 42 were under 1 year, 71 under 5 years, 61 over 60 years, 16 over 80 years of age.

Typhoid Fever. With regard to typhoid fever, during the past year we have been fortunate in having the lowest number of cases for the past six years, viz., 43 cases, with 4 deaths, and, as compared with last year, when 67 cases, with 7 deaths, were reported, it is quite a gratifying record.

And taking into consideration the water supplies as a factor in the disease, it was found that, notwithstanding the benign influences of the abundant rainfall, etc., of the past summer upon the wells, it was from this source, particularly in the unsewered portions of the city, that our typhoid occurred, viz., of the above 43 cases, 27 were well, 7 well and city, and 9 city water users ; of the latter, in the majority of cases, extreme local conditions, such as bad drainage, etc., were present.

I think, therefore, the above facts urge upon us the necessity of not only abolishing all wells, but that the lower and undrained portions of the city should be supplied with public sewers.

Scarlet Fever. During the past twelve months 37 cases of scarlet fever, with no fatalities, occurred, infecting in all 29 houses. The cases for the most part have been extremely mild, as the absence of any deaths would indicate.

Smallpox. Two cases of mild smallpox occurred during the fore part of the sanitary year, one having as a source of infection a case reported in last year's tary year, one having as a source of infection a case reported in last year's records, the last being from a patient who contracted the disease in the neighborhood of Jarvis, in the Township of Woodhouse, and who visited here when he developed the disease, but returned to his home before it was known what he had. Both the above cases ran the ordinary course and made good recovery.

Measles, Chickenpox, and Whooping Cough. Of the above, 37 cases were recorded at the Health Office, with two deaths, one of measles, the other of whooping cough.

Diphtheria and croup. Of diphtheria and croup we have had, after two or three years of comparative freedom from the disease, during the past year 72 cases, with 12 deaths, the cases occurring for the most part sporadically, with but few cases of any history of direct source of infection from pre-existing cases. Particularly has it been noticed that adults were largely in this class of cases, while the deaths were amongst the infantile class, most of whom had the laryngeal type of the disease.

The cases for the most part have occurred in the lower lying portions of the city, where in most instances the cellars were wet and buildings damp, which was undoubtedly an active factor in rendering patients susceptible to the invasion of the bacillus, which not infrequently exists in healthy throats, awaiting a proper condition for development, and which, I believe, in not a few cases of unsuspected sore throat is the causative factor, and, in not being brought to notice, frequently spreads the infection again, from the variable time the baccilus remains in the throat after the disappearance of the membrane in patients isolated. A stated period of quarantine is not always satisfactory. This brings up the advisability of a laboratory, in which a bacteriological examination, both of suspects and convalescents, should be made to determine the wisdom of their mingling with the public. Now, as I have before brought this matter before you, and as the above is only one of the many needs for such a laboratory in connection with the Department, I am quite sure you will agree with me that the advantages that will arise from it will more than compensate for the outlay, which I must say is an absolute necessity to the office.

Garbage system. In the matter of garbage system, I feel that the Board is of one accord, and realize its necessity both as a public convenience and a public safety, and I would once more recommend that the Board urge upon the City Council its views in the matter to have it established and put in operation at the earliest possible date.

Isolation Hospital. As the province of this Board has in matters relating to contagious diseases much in common with the administration of the Isolation Hospital, and more particularly with the indigent class of patients, for whose treatment the hospital is largely required, and for the medical care of which some provisions are necessary, therefore, since the responsibility of this matter affects both this Board and the hospital, I think that for the mutual advantage of both some one should be appointed to attend to this matter at the earliest convenience.

All of which is respectfully submitted for your consideration.

I am, your obedient servant,

T. G. E. PEARSON,
Medical Health Officer.

Report of Sanitary Inspector.

To the Chairman and Members of the Local Board of Health:

Gentlemen: The following is a brief report of the work performed by your Sanitary Inspector during the past twelve months:

161 inspections of premises for contagious diseases, and serving 109 notices upon schools, churches, and library in connection with the same ; 160 sewer notices were served, and inspections of the work from time to time, to see the progress of the work, of which 90 are now complete, 70 not yet attended to ; 64 complaints for general nuisances were investigated, and the cause removed.

Besides the above, with the taking over of the night soil contract by the city, I had to visit in all about 4,000 premises to find out the sort of closets in use, over 3,000 of which were dry earths and 150 pits. All the latter I have had cleaned and abandoned, except where they comply with the requirements of the law. Since the 1st of February I have had to look after the cleaning of all these closets, and furnish the city clerk with a complete list of them. Since the beginning of the year about 100 have been abolished by the parties owning them making sewer connections, while about the same number have been added through the building of new houses where sewers are not to be had.

During the year the dairies have been inspected, and about 30 milk permits granted.

I have also, from time to time, collected samples of milk from the different supplies to be tested, and assisted in the testing of the same.

All of which is submitted for your consideration.

I am, your obedient servant,

(Sgd.) J. A. CHAPMAN, S. I.

STRATFORD.

Report of Medical Health Officer.

To the Chairman and Members of the Local Board of Health:

Gentlemen: Appended you will find report of Sanitary Inspector Durst, which will give you a statement of the sanitary work done during the year.

The citizens have much to be thankful for, for scarcely in the history of the city has it been so free from contagious diseases, as in the last year. Only two cases of scarlet fever and one of diphtheria were reported since last April.

The case of diphtheria was brought in from a neighboring city, but by careful watching and isolation. no other cases developed.

Not a single death has been recorded from scarlet fever or diphtheria. Two deaths occurred during the year from whooping cough, and one from typhoid fever. Consumption again heads the list, 14 deaths being reported as occurring from that disease. In 1901 there were 10 deaths, in 1900 10, in 1899 12, in 1898 13 from that disease, a slight increase over the previous years, or, taking the entire number of deaths, one out of seven died from that disease.

In a previous report I mentioned the steps that were being taken towards the erection of a hospital for the treatment of those suffering from consumption. I am pleased to state that steady progress towards that end is being made.

No further steps have been made towards the erecting of a place for treating contagious diseases. Advising, entreating or soliciting seems to have no avail.

Continued progress is being made in the sewage disposal works, and the laying of sewers. The active chairman keeps up his usual zeal and vigor.

Your obedient servant,

J. A. ROBERTSON.

Sanitary Inspector's Report.

To the Chairman and Members of the Local Board of Health:

Gentlemen: I have the honor to submit to you my Annual Report of the work done during the year, ending October 31st, 1902.

I had the usual number of health notices posted up in the month of April, and had one clause calling attention to the letter box at the health and relief office to leave any notices or complaints to be looked after. There were in all one hundred and fifty-four notices left, which were all promptly attended to.

Inspected all cellars in business part of city, and note quite an improvement in the majority of cellars; but there are still a number of merchants where I had to call repeatedly to have thorough cleanliness enforced.

Had considerable trouble with lane on north side of Ontario street, east of post office, partly on account of so many repairs to buildings and change of tenants, and also to the weather being unfavorable, which caused considerably delay in removing rubbish.

I placarded, in all, nineteen dwellings during the year for contagious disease, eight of which were for diphtheria, and eleven for scarlet fever; all of which were thoroughly disinfected. Also all dwellings where persons died from consumption were thoroughly disinfected.

In company with Medical Health Officer Robertson, I inspected the milk supply of the city, visited all dairies, inspecting all cows as to general health, and barns and surroundings as to cleanliness and ventilation; took samples of water from wells where cattle are watered, and also that used for washing milk cans.

Collected samples of milk whenever called upon to do so by Medical Health Officer Robertson, reports of which had been in the daily papers at the time.

Inspected all back yards, lanes, and alleys, and had accumulation of rubbish there removed, and in general, enforced all regulations of the Health Act.

All of which is respectfully submitted.

Yours obediently,

GEO. DURST,
Sanitary Inspector.

Stratford, November 17, 1902.

LONDON.

Report of Medical Health Officer.

To the Chairman and Board of Health:

Gentlemen: In presenting my annual report, for the year ending November 15th, I have to repeat what I said in last year's report as to the very satisfactory condition of the city's health. Five hundred and seventy-four deaths occurred during the year, exclusive of 34 still-born, which are not counted in mortuary statistics. Consumption, as usual, carried off the largest number, viz.: 65, as compared with 48 last year, and 60 the year before. Pneumonia, also a disease of the lungs, comes second in the list, with 48 deaths. Leaving out what is called heart disease, which may mean anything, organic disease of the heart caused the deaths of 43 persons, and cancer, 29. There were 18 deaths by violence, of which two were suicides. There is a very satisfactory and comforting increase in the number of deaths from old age, siz.: 36, from octogenarians to the century mark. The number of deaths due to infectious diseases is comparatively small, viz.: 25, as follows: Diphtheria, 20; typhoid fever, 3; measles, 2, and none whatever from scarlet fever. This is a very low death rate from what is called preventable diseases for a city of London's population, and breaks the record for typhoid and scarlet fever. It is especially so when the difficulties contended against are considered. Many parents show an utter disregard of the golden rule, allowing their children, while convalescing from mild forms of scarlet fever, to mix with other children; send them to stores, and sometimes to school. Placarding a dwelling is a notice to the public to keep away from that dwelling, and that the inmates must remain at home, but there are cases where it would require the establishment of a "peaceful blockade," by a police constable, to effect complete isolation. Some of the city physicians are equally culpable, for they, knowing the requirements of the Public Health Act, at the solicitation of the parents, do not report all the cases coming under their notice. Although there were no deaths during the year from scarlet fever, there was an unusually large number of sporadic cases of a mild type, many of them due to the carelessness of parents and neglect of physicians. Hereafter physicians and householders neglecting to promptly report all cases of infectious diseases, in accordance with the Act, will be given opportunities in the police court to explain why they did not do so.

The death rate for the year is 14.6 in the 1,000.

One hundred and seventy-eight herds and dairies were examined during the year. One cow was found with actinomycosis bovis (lump jaw), and destroyed. An examination of 161 samples of milk gave an average of 4 per cent. of butter fat; 2 samples had cream added, and 2 cream removed. The average shows that London is being supplied with good milk. The public ice supply comes from the same sources as allowed by the Board a few years ago, and has been of fairly good quality; that obtained from the Cove being sold for cooling purposes only, and so far there is no evidence that it has been used in any other way.

No improvement has been made in the Covent Garden Market. The building should either be put in proper condition, or town down.

Several complaints were made during the year that the Talbot Street School is not in a sanitary condition. There were bad odors in the school at times; especially was this the case upon reopening the school in September, after the holidays. This school is heated and ventilated by the Smead Dowd system, and as long as the doors and windows are kept closed, the furnace and stacks will both heat and ventilate. But these large furnaces can only be used in the winter. For ventilation when the furnaces are not in use, also for the destruction of waste material, two small stacks are kept burning during the summer, and accomplish what they are intended for. During the holidays these are not kept burning; consequently, when the school opened in September, one or two weeks elapsed before all waste matter was rendered inocuous. This is the way the Smead system works, and it can work no other way. It will heat buildings well, but for ventilating purposes it is not safe. So far as the Talbot Street School is concerned, I do not think there will be any further trouble, and the janitor is a very efficient one. Traps have also been put in the water pipes.

The last two cases of smallpox were discharged from the isolation hospital in February last. No epidemic visited the city during the year.

The population of the city, according to the Assessment Commissioner returns, is 39,265.

T. V. HUTCHINSON,
Medical Health Officer.

ST. CATHARINES.

Report of Chairman of Local Board of Health.

To the Mayor and Council of the Corporation of the City of St. Catharines:

Gentlemen: I have the honor to submit my report on the sanitary condition of the city, for the year ending the 15th day of November, 1902.

Contagious Diseases. We have been remarkably free from contagious diseases and zymotic diseases during the past year, as will be seen by consulting the accompanying report of the Secretary of the Board. There was one case of smallpox which developed itself here, having been contracted in the city of Cleveland, Ohio. The house in which the disease occurred was, fortunately, rather isolated, and was, in consequence, more easily quarantined. His Worship the Mayor, in order to meet the emergency, appointed Dr. R. H. Smith, who held the position of Medical Health Officer during the existence of the three cases of smallpox last year, to take charge of the case; and the Board of Health stationed sanitary guards near the premises containing the patient, to prevent unauthorized ingress and egress. Three inmates of the house were exposed to the contagion, but they were successfully vaccinated, and none contracted the disease. The result was satisfactory, so far as accomplishing the result sought for was concerned; but a good deal of expense was incurred, as the family had to be sustained by the city, and the bread-winners confined to the house until all danger of spreading the contagion was obviated. It is earnestly to be hoped that the council, both on financial and humanitarian grounds, will take steps to secure a building for the housing and treatment of contagious diseases, at as early a date as possible, inasmuch as the city is liable at any time to be subjected to the invasion of smallpox, from outlying localities, where it often exists in an epidemic form, owing to neglect on the part of the sanitary authorities to take and maintain proper precautions.

Flush Tanks. Two flush tanks have been installed this year—one on Welland avenue, near Napier street ; the other on Wellington and Lake streets, near the Simcoe Canning Factory. Both of these tanks, as well as those in other parts of the city, have been recently examined by the Sanitary Inspector and Mr. O'Neill, and have, without exception, been found to be in good working order.

Water Supply. I had the pleasure of examining the source of the water supply of the city, through the kind invitation and courteous hospitality of the Water Commissioners. I was much pleased to observe the marked improvements they have effected in the surroundings of the upper and lower reservoirs. I particularly noticed the inlet of the water at Higgins' flume, and am convinced that the method adopted there to properly aerate the supply as it passes from the canal through the flume, is as efficient as it is simple, and that it must serve, in a measure, to oxidize and neutralize the objectionable and unsanitary characteristics of the organic matters which the canal receives between Port Colborne and the intake at the flume. It is greatly to be desired that the Water Commissioners should be placed in a position to enable them to make the necessary alterations by which to accomplish the thorough cleansing of the lower reservoir; as it contains, under cover of the fresh and pure-looking water, a dense substratum of black, foul smelling, organic debris, in a state of decomposition, which it would be unsafe to disturb until connections can be made to supply the city with water from the upper reservoir.

Anti-tuberculosis. The recent and very important medical congress in Berlin, Germany, for the discussion of the best methods for the prevention and cure of tuberculosis, should stimulate all sanitary and municipal authorities throughout the civilized world to take precautionary measures to guard the public against the causes which lead to its inception and development, both in men and lower animals. It is a source of satisfaction to find that the steps taken by our Council and Local Board of Health, to make the practice of spitting on the sidewalks and in public places punishable, were recommended for universal adoption. The dissemination through the atmosphere of dried tuberculous sputa is now recognized as one of the most fertile sources of tubercular infection; and the course pursued here, of stamping on telegraph and trolley poles throughout the city the prohibition of the practice of promiscuous expectoration, will, if the police do their duty, prove an undoubted benefit, and a safeguard to our citizens. The efforts being made by the Council to utilize the borrowing powers, obtained from the Local Legislature, for the construction and maintenance of good roads, and the extension of our sewerage system, are to be highly commended. Should this privilege be granted, the results cannot fail to be beneficial, from a sanitary point of view, as it will enable the Council to take steps to abolish the unwholesome latrine vaults, of which constant and quite justifiable complaints are being made to the Local Board of Health by citizens in certain residential sections of the city, where this malodorous nuisance more extensively prevails. It is gratifying to notice the very marked reduction in the number of deaths from tuberculosis during the current year. Twenty-five deaths from tubercular disease having been reported for 1901, and only 18 for 1902, a difference of nearly 30 per cent. in favor of this year, such a marked improvement must, in a great measure, be due to improved sanitary surroundings and greater precautions, both public and private, to guard against contagion. The hospital authorities are to be commended for the steps initiated, at the recent meeting of the trustees of that most excellently managed institution, to provide accommodation for the reception of persons suffering from contagious diseases. The total number of deaths recorded during the year within the city limits was 162. Deducting from this number those inmates of the hospital from outside localities who died here, and also those who died from old age, premature birth, accidents, and suicide, I find that the rate of mortality per 1,000, based upon a population of 10,590, is 12.18, which I consider to be a most satisfactory showing, and good evidence of the healthful condition of the city. The services rendered by the Secretary, Sanitary Inspector, and the acting Medical Health Officer, have met with the entire approval of the Board; and the limitation, both last year and this year, of the smallpox cases to the quarantined houses, is convincing proof that all the sanitary officials performed their duties in a very creditable manner.

All of which is respectfully submitted.

E. GOODMAN, M. B.,
Chairman Local Board of Health.

Report of Sanitary Inspector.

To the Chairman and Members of the Local Board of Health of the City of St. Catharines:

Gentlemen : Your Sanitary Inspector begs to submit his annual report as Sanitary Inspector to your honorable Board for the year ending November 15, 1902. And would say I have made eight houndred house-to-house visits, placarded twenty-six for contagious diseases, and fumigated six where contagion had existed. I have visited and inspected the following places: City and county cow byres, slaughter houses, hide houses, city livery and hotel stables, and canning factories, and have pleasure in saying all are well kept and in good sanitary condition. I have regularly tested the milk from the licensed milk vendors; the register has been very satisfactory, none registering below 90. The city scavengers have removed over eight hundred barrels of night soil, and performed their duties well. The city flush tanks have frequently been inspected during the year, and very recently; they are working very satisfactorily.

All of which is respectfully submitted.

A. BOULDEN,
Sanitary Inspector.

St. Catharines, 15th November, 1902.

E. Goodman, Esq., Chairman Local Board of Health:

Dear Sir: I have the honor to submit to you herewith a statement of the number of deaths occurring in the city of St. Catharines, from 15th November, 1901, to the 15th November, 1902, and the causes thereof, together with a statement of the number of contagious diseases reported during the same period:

Apoplexy	5
Appendicitis	3
Accident	2
Alcoholism	2
Asthma	1
Bronchitis	8
Bullet wound	1
Broken back	1
Congenital weakness	4
Cancerous affections	9
Convulsions	3
Cholaemia	1
Cholera infantum	1
Consumption	18
Drowned	2
Diphtheria	1
Epilepsy	1
Erysipelas	1
Enchondroma	1
General debility	1
Gangrene	1
Hemorrhage	5
Heart disease	14
Inanition	2
Inflammation of lungs	1
Insanity	1
Kidney diseases	5
Meningitis	4
Marasmus	1
Mal-nutrition	2

Neuritus	1
Obstruction of bowels	1
Paralysis	4
Paresis	1
Peritonitis	2
Placenta praevia	1
Pneumonia	14
Premature birth	1
Protracted birth	1
Rheumatism	2
Septicaemia	4
Still born	9
Senile decay	6
Suicide	1
Syncope	2
Tetanus	2
Tumor of brain	1
Typhoid fever	5
Ulcer	1
Whooping cough	1
Total	162
Contagious Diseases reported—	
Scarlet fever	12
Measles	7
Diphtheria	6
Smallpox	1
Total	26

Your obedient servant,

JNO. S. McCLELLAND,
City Clerk.

OTTAWA.

Annual Report of the Medical Health Officer.

To the Chairman and Members of the Board of Health:

Gentlemen: I beg to present the annual report of the Health Department for the year, 31st October, 1902.

For us it has been an eventful year, its close seeing the isolation hospital, for which your Board and my predecessor, Dr. Robillard, have so long contended, almost completed.

When completed, we shall have an institution of which Ottawa may well be proud. The urgent need of this institution is shown in the record of contagious diseases reported, the number of which has been steadily increasing, scarlet fever, especially, showing 200 cases in 1900, 391 in 1901, and 689 in 1902. It is utterly impossible to isolate the cases properly in their homes.

During the year some 309 cases of smallpox occurred, many of these coming to us from outside of city. The fact that only one case died on the island, and that a child, which had been concealed at home until too ill to save it, speaks volumes for the care given the patients by those in charge of the hospital. Fortunately, our city is now practically free from the disease, and by thorough vaccination, we should avoid any recurrence of the trouble this coming year. Certainly our vaccination of last year saved us a tremendous number of cases, and was the chief agent in staying the epidemic.

A review of the mortality table appended shows that 1,156 deaths occurred in Ottawa during the past year, 117 less than in the preceding year. This, at the estimated population of 61,137, gives a rate, per thousand, of 18.9. As many of these deaths are of those from other municipalities, coming to different hospitals and homes for treatment and care, the actual death rate of our own population will be still lower, showing Ottawa to be a naturally healthy spot.

As guardians of the public health, it is our duty to use our every endeavor to make this rate still lower. The three most infectious diseases we have, i. e., scarlet fever, diphtheria, and smallpox, have, during the year, caused but 80 deaths all told, owing to the preventive measures put in force by your Board; while tuberculosis alone has caused 140 deaths, or ⅛ of the total mortality, despite the fact that it is much less contagious than any of these three, yet it has been practically ignored by us.

When we know that it is both a preventable and curable disease, and that it is the cause of so much illness and misery, I consider that this is the most important matter that can engage the attention of your Board during the coming year.

But 28 deaths from diphtheria, as compared with 65 deaths from this source in 1901, is a very pleasing feature of the report. This improvement is, I think, largely due to the more general use of the antitoxin in the treatment of this disease. It is to be hoped that the work of those aiming to develop a similar remedy for scarlet fever may soon be crowned with success.

I trust that this year will see the agitation for a civic scavenging system successful, as each year's growth of the city renders it increasingly urgent.

The frequent complaints received at our office in regard to defective sanitary arrangements in houses, rendered the appointment of a qualified plumber as an inspector a matter of importance, as defective plumbing is always a menace to health.

Now that we are on the eve of entering our new isolation hospital, I think it only due to those who have labored so earnestly in the two old hospitals, that I should place on record my appreciation of the splendid services they have rendered us. During this year, especially, they have been taxed to their utmost, and everything possible has been done by those in charge to contribute to the care and comfort of the patients.

I beg also to present the report of the Sanitary Inspector, which contains some important recommendations on the matters which have come more especially under his notice.

In conclusion, I have much pleasure in testifying to the excellent service rendered by the staff of the Department.

Respectfully submitted.

December 5th, 1902 (Signed) ROBERT LAW, M. D.

Report of Sanitary Inspector.

Disease.	Nov.	Dec.	Jan.	Feb.	Mch.	April.	May.	June	July.	Aug.	Sept.	Oct.	Total.
Abscess	....	1	....	....	....	....	....	....	....	....	....	....	1
Accidental or violent :—													
Burn	....	....	....	....	....	....	1	....	....	....	....	1	2
Cutting throat	....	....	1	....	....	....	....	....	....	....	....	....	1
Drowning	....	2	....	....	....	....	1	3	1	....	1	....	8
Electricity	....	....	1	....	....	....	....	....	....	....	1	....	2
Explosion	....	....	1	....	....	....	....	....	....	....	....	....	1
Fall	....	1	....	1	....	....	....	2	1	2	....	1	8
Poisoning	....	....	....	1	....	1	....	1	....	1	....	1	5
Railroad	....	....	....	1	....	1	....	1	....	1	....	....	4
Shooting	1	....	....	....	1	....	1	....	....	....	....	....	3
Suffocation	1	1	1	2	....	....	....	....	....	....	....	....	5
Alcoholism	....	....	....	....	....	....	....	....	....	1	....	....	1
Anaemia	....	....	1	3	....	1	....	1	....	....	1	1	8
Aneurism	....	....	....	....	....	1	1	....	....	....	1	....	3
Appendicitis	....	....	....	....	3	1	....	....	....	1	....	1	6
Asthma	....	....	1	....	....	1	....	....	....	....	....	....	2
Bronchitis	1	3	2	3	2	1	4	4	....	4	....	2	26
Cerebral abscess	....	....	....	....	1	....	....	1	....	....	....	....	2
Cerebral hemorrhage	1	....	2	3	....	2	....	5	5	2	....	1	21
Cerebral tumor	....	....	....	....	1	....	....	....	....	....	....	....	1
Cirrhosis of liver	....	....	1	1	....	1	....	....	1	....	1	2	7
Convulsions	8	6	6	4	6	3	10	5	5	9	....	3	45
Congenital defect	....	1	1	1	1	2	3	2	3	1	2	1	18
Croup	1	1	....	....	....	....	....	....	....	....	2	....	4
Cystitis	....	....	....	....	....	....	....	....	....	1	....	1	4
Debility infantile	10	9	10	5	9	6	9	9	11	13	9	8	108
Debility senile	5	5	8	6	4	8	14	8	18	3	9	5	93
Dementia	1	....	....	1	....	....	....	....	....	....	....	....	2
Diabetes	....	1	1	....	....	....	....	....	....	....	1	1	4
Diarrhœa	4	....	3	4	7	4	1	6	24	29	9	4	95
Diphtheria	1	2	5	1	6	....	....	2	2	2	1	8	28
Dropsy	1	....	....	....	....	....	1	....	....	....	....	....	2
Dysentery	....	....	....	....	1	....	....	....	....	....	....	....	1
Dyspnœa	3	....	....	....	....	....	....	....	....	1	1	1	6
Eclampsia	1	....	....	....	1	....	1	1	....	1	....	....	5
Ectopic gestation	1	....	....	....	....	....	....	....	....	....	....	....	1
Emesis	....	....	....	....	....	....	....	....	....	1	....	....	1
Embolism	....	....	....	....	2	....	....	....	....	....	1	....	3
Epilepsy	1	....	....	1	....	....	....	....	....	....	....	....	2
Empyenia	1	....	....	....	1	....	....	....	....	....	....	....	2
Erysipelas	1	1	....	1	....	....	....	....	....	....	....	....	3
Exopthalmic goitre	....	....	....	....	....	....	1	....	....	....	....	....	1
Gangrene	....	....	2	....	....	....	....	....	....	....	....	....	2
Hemorrhage	....	....	....	....	2	....	....	1	....	2	....	....	5
Heart disease	10	3	10	9	10	2	7	6	3	5	4	6	75
Hernia	....	....	....	....	....	....	....	....	....	1	....	....	1
Influenza	....	....	....	1	....	....	....	....	....	....	....	....	1
Intestinal obstruction	....	....	1	1	....	1	1	....	....	....	1	1	6
Intestinal rupture	....	....	....	....	....	1	....	....	....	....	....	....	1
Jaundice	....	....	....	....	....	....	....	....	....	....	1	....	1
Malignant growth	3	6	2	5	2	5	1	7	3	3	6	2	45
Meningitis	3	5	....	2	4	2	3	....	3	4	4	1	31
Nephritis	1	1	3	2	4	4	....	4	1	....	....	2	22
Obstruction of Oesophagus	....	1	....	....	....	....	....	....	....	....	....	....	1
Paralysis	1	2	2	2	....	1	2	1	....	1	1	....	13
Pemphigus	....	....	....	....	....	....	....	....	....	....	1	....	1
Peritonitis	....	1	....	3	3	4	2	....	....	....	3	4	20
Pneumonia	3	6	11	9	12	9	17	3	5	2	3	3	83
Pneumonihoniosis	....	....	1	....	....	....	....	....	....	....	....	....	1
Premature birth	2	2	2	4	....	3	3	1	3	5	2	3	30
Rachitis	....	....	1	....	....	....	....	....	....	....	....	....	1
Rheumatism	....	....	....	....	1	....	....	....	....	....	....	....	1
Scarlet fever	11	5	3	2	6	5	4	4	2	3	1	4	50
Shock	....	....	1	....	1	1	....	....	....	....	....	....	3
Septicoemia	2	1	2	1	6	2	2	2	1	....	....	....	19
Syphilis	....	....	....	....	....	....	....	1	....	....	....	....	1
Tabes Dorsalis	....	....	1	....	....	....	....	2	....	....	1	1	5

REPORT OF SANITARY INSPECTOR.—*Con.*

Disease.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Total.
Typhoid	5	....	2	1	1	2	...	4	1	1	4	1	22
Tuberculosis	8	8	8	17	16	24	10	17	4	10	6	12	140
Variola	....	1	1	....	....	....	....	....	....	....	....	....	4
Whooping cough	....	....	..	1	....	....	....	1	1	....	....	1	3
Unknown cause	....	...	1	1	....	....	....	....	....	....	1	...	2
Total	92	76	99	100	117	100	100	105	98	110	77	82	1,156
Exclusive of still births	9	9	6	3	6	9	8	10	5	2	10	8	85

	Protestant annex.		R. C. annex.		Porter's Island.
	Diph.	Scar.	Diph	Scar.	Smallpox.
Admitted	117	153	84	235	309
Discharged	105	142	80	215	304
Died	10	9	4	15	1

Disease.	Number.
Diphtheria	234
Scarlatina	689
Smallpox	309

Reports on other diseases unreliable.

How disposed of.	Number of children.
Admitted during year	227
Placed outside or returned	102
Died during year	90
Remaining in Home, November 1st, 1902	35

The Chairman and Members of the Board of Health:

Gentlemen: I beg to bring under your notice the annual statement, showing the work done by the sanitary section of the Department under your control during the year ending October 31, 1902.

In addition to the ordinary routine work of the section, there have been 1,023 houses disinfected, 374 cards put up on houses were infectious disease had existed, and 322 taken down.

In the ordinary course of duty, I have to report that 7 drains have been tested, 3,100 privy vaults cleaned, and 196 written notices were issued to property owners and tenants. In the great majority of cases, however, verbal notice has sufficed to secure due attention. One summons was issued, and one conviction followed.

Infectious Diseases. The number of houses disinfected was double that of the preceding year, owing to the outbreak of smallpox, scarlet fever, and diphtheria.

Dumping Grounds. The four dumping grounds of the city have received proper attention.

Removal of Garbage. The conveyance of garbage and kitchen swills through the streets of the city has been carried out in compliance with the by-law.

Sundry Trades. The inspection of several trades, which might become offensive through insufficient attention, has been attended to monthly.

Manure. The regulation for the disposal of manure, and the piling of it in yards, should be very clearly defined, and strictly enforced, particularly during the summer months. Covered boxes should be insisted on in the hot season.

Dairies. Having inspected nearly 40 dairies during the months of July and August, I found that most of the proprietors were making the needed repairs and improvements for the better ventilation and accommodation of their cattle.

The water used by the animals was likewise drawn from sources free from any danger of contamination.

Supervision of Ice Cutting. Several complaints were received to the effect that ice was being cut outside the area prescribed by the Board, and the offenders were notified accordingly.

Public Urinals. During certain hours of the day a large proportion of the citizens have business in the central parts of the city, there are many casual visitors, there are several hack stands, where the drivers spend long hours, etc., and yet there is scarcely any public provision for their convenience.

Were some effort made to supply this deficiency, it would gratify both residents and visitors, who would not be under the necessity of violating the rules of public decency.

Drainage. It is greatly to be regretted that, notwithstanding the strenuous and costly efforts made by the civic authorities for the disposal of sewage, that there are so many private tenements without any, or with inadequate drainage ; the only effective remedy for the supervision of this dangerous nuisance would be to empower the Engineering Department to inspect such premises, and to order the necessary sewage connections to be made under provisions similar to those of the "Local Improvement Act."

Slaughter Houses. A number of these establishments have been visited during the year. It would be idle to enter into a detailed report of their defects, or to offer suggestions for their improvement ; they are all more or less offensive, and detrimental to the public health of the city. There can be but one solution of this much debated question : the erection, in a sufficiently isolated position, of a public abattoir, thoroughly equipped, and efficiently supervised. This system has been introduced in many cities, and has amply justified its adoption.

In conclusion, I have much pleasure in stating that all work entrusted to my assistant has been promptly and carefully performed.

My sincere thanks are due to the Chairman, members, and Medical Health Officer of the Board for their unfailing courtesy and readiness to afford me every assistance in their power.

The whole respectfully submitted.

(Signed) G. O. S. LAFLAMME,
Sanitary Inspector.

Ottawa, October 31st, 1902.

WOODSTOCK.

Report of Medical Health Officer.

To the Mayor and Members of the Council of the City of Woodstock :

Gentlemen,—I beg to submit the following as my report for the year ending November 15th, 1902 :

I am pleased to inform you that the health of our citizens has been exceptionally good, and death rate lower than for several years past. We attribute that condition, in a great measure, to the active co-operation of our citizens in sanitary matters, and by the further extension of our sewer and scavenger systems, the health of our citizens would doubtless be much improved and mortality lessened.

We would recommend that the lanes in the rear of the business portions of Dundas street be properly drained and graded, thereby placing them in a sanitary condition.

As milk is largely used as an article of diet, especially for children and in sickness, and as cholera infantum and typhoid fever, etc., can frequently be traced to impure milk, your Board has causd the milk sold by vendors to be thoroughly tested twice during the year. The result showed all up to Government standard.

Herds, byres, approaches, water supply, etc., were properly inspected by Dr. Rudd, veterinarian. His report indicated that our milk vendors were endeavoring to supply a good quality of milk, as herds, appliances, etc., were in good condition.

The water in many of our wells was tested. Some of the wells were so polluted that they were ordered to be cleaned out and filled up with clean earth ; others cleaned out. Would recommend every citizen to use city water thereby insuring them against many ailments.

During the early part of the year measles were very prevalent ; 115 cases were posted. No deaths. A few sporadic cases of scarlet fever, diphtheria, and typhoid fever were reported, some of them being traceable to outside municipalities.

Only one card has been posted during the past four months, viz., a case of scarlet fever, contracted elsewhere, thus indicating that our city is in a comparatively healthy condition.

During the month of July a case of smallpox was reported. Prompt measures were adopted by your Board, and approved of by our Mayor, to prevent the spreading of the same. The Provincial Board was notified of the outbreak, and Dr. Hodgetts, Provincial Health Inspector, visited the patients, and approved of our procedure. The patient made a good recovery. Quarantine was raised in about five weeks. No further outbreak. We would recommend that the Council take into its most serious consideration the erection of an isolation hospital for contagious diseases. We believe it would be the means of saving lives, lessen the spreading of infectious disease, and be a financial gain to our citizens.

Number of deaths during the year, 94, or about 10 per 1,000—a low mortality. Some of those died in the hospital, who belonged to outside municipalities.

Number of deaths from tuberculosis, 8 ; pneumonia, 7 ; typhoid fever, 3 ; scarlet fever, 2 ; measles, 0 ; diphtheria, 2 ; cholera infantum, 2 ; cancer, 5 ; heart disease, 12.

It may be noted that tuberculosis has greatly decreased during the two past years.

All of which is respectfully submitted.

A. McLAY,
Medical Health Officer.

Woodstock, November 30th, 1902.

WINDSOR.

Report of Secretary.

Windsor, December 16th, 1902.

To the Chairman and Members of the Board of Health :

Gentlemen,—Pursuant to the requirements of the Health By-law, I herewith place before you a statement of the deaths rgistered in this city from January 1st of the current year down to and including the 15th instant, showing the causes of death, and the age and sex of the deceased, as reported by the attending physicians ; and also a statement of the number and nature of the contagious diseases (as the latter term is understood) reported during the same period.

I have the honor to be, gentlemen, your obedient servant.

STEPHEN LUSTED,
Secretary.

Deaths and their Causes. As registered from January 1 to December 15, 1902, inclusive.

DEATHS AND THEIR CAUSES.

As registered from January 1 to December 15, 1902, inclusive.

Disease causing death.	No. of cases.	Age of deceased.	Sex of deceased.
Appendicitis	1	40 years	m
Albuminurea	1	2m	f
Asthenia	1	78	f
Apoplexy	3	91, 86, 70	m, m, m
Angina Pectoris	3	8, 50, 48	f, m, m
Acute Laryngitis	1	5	m
Acute Rheumatism	1	66	m
Abdominal Tumor	1	69	f
Accident	1	14	m
Abscess of Stomach	1	49	f
Broncho-Pneumonia	7	1. 10m, 1, 1, 4, 3 wks, 10	m, m, m, f, m, m, m
Brain Fever	1	10 m	m
Bronchitis	4	85, 73, 85, 3m	f, m, f, m
Brights' Disease	1	4	f
Cerebral Thrombus	1	70	f
Cyanosis	1	1 day	f
Cancer of Stomach	2	55, 40	m, m,
do Breast	1	59	f
do Liver	1	72	m
do Neck	1	67	m
Cancer	1	72	f
Cystitis	3	74, 61, 79	m, m, m
Congestive Chills	1	69	f
Carcinoma of Bowels	1	50	f
Cerebral Hæmorrhage	1	68	f
Congestion of Lungs	1	30	m
Concussion of Brain	1	50	m
Cholera Infantum	3	3m, 1, 1	m, m, f
Carcinoma	1	53	m
Chronic Diarrhœa	1	48	f
Calcareus degeneration of Arteries	1	64	m
Diphtheritic Croup	2	4, 12	m, f
Diphtheria and Scarlet Fever	1	5	m
Diphtheria	1	5	m
Double Pneumonia	1	1	m
Drowned	3	foetus, 12, 25	f, m, m
Died at Birth	1	....	m
Dysentery	1	44	m
Epilepsy	1	60	m

Disease causing death.	No. of cases.	Age of deceased.	Sex of deceased.
Endocarditis	1	61	m
Fibroid Phthisis	1	51	m
Found dead in bed	1	45	m
Fibroid Tumor	1	50	m
General Anaemia	1	91	m
General Dropsy	1	70	f
Heart Failure	5	53, 56, 56, 2, 64	m, f, m, f, m
Heart Disease	6	66, 53, 77, 50, 80, 30	f, m, f, f, m, m
Heart Disease with Phthisis	1	23	m
Hydrocephalus	1	8m	f
Kidney derangement with Uraemia	1	75	m
Malnutrition	3	$3\frac{1}{2}$m, 1, 1	m, f, m
Marasmus	7	3wks, 6m, 3hrs, 4, 6m, 10m	m, f, m, f, m, m, m
Malassimilation	1	8m	f
Meningitis	8	4m, 5m, 4, 1, 3, 16, 4m, 5m	f, f, m, f, m, f, f, f
Measles	3	4m, 8m, 18m	f, m, m
Malignant disease of Rectum	1	61	m
do do Uterus	1	51	f
Mitral disease of Heart	1	39	f
Nephritis	2	12, 44	f, m
Old Age	1	87	f
Paralysis	3	72, 56, 88	f, m, m
Pneumonia	21	6m, 2, 27, 18m, 4, 67, 78, 19, 2, 1, $\frac{3}{4}$, 1m, 72, 3, 67, 65, 3, 70, 3, 69, 36, 58	m, m, f, m, m, f, m, m, f, f, f, m. f, m, m, m, m, f, m, m, f
Phthisis	5	41, 44, 16, 23, 20	f. f, m, f, f
Pneumonia with Whooping Cough	1	$1\frac{1}{2}$	f
Pulmonary Consumption	1	44	f
Pulmonary Phthisis	1	22	m
Poison	1	19	f
Paresis	2	72, 45	m, m
Pernicious Anaemia	1	24	f
Phthisis Tuberculosis	1	32	f
Premature Birth	3	....	m, f, f
Puerperal Peritonitis	1	20	f
Pelvic Cellulitis	1	21	f
Phthisis Pulmonalis	2	59, 22	m, f
Stillborn	6	....	m, f, m, f, f, m
Senile Decay	3	85, 75, 76	m, f, f
Scarlet Fever	1	19	f
Senile Gangrene	2	74, 86	f, m
Softening of Brain	1	84	f
Streptococcic Infection	1	29	f
Sarcoma of Neck	1	49	f
Strangulation	1	10m	f
Tumor in Brain	1	48	m
Tuberculosis	3	39, 25, 35	f, f, m
Tubercular Meningitis	1	6	m
Typhoid Fever	2	6, 26	m, m
Typho-Pneumonia	1	26	m
Tonsilitis	1	3m	f
Tuberculosis (Pulmonary)	1	21	m
Uræmia	2	61, 73	m, m
Uramic Poisoning	1	74	m
Valvular disease of Heart	3	51, 84, 26	f, f, f
Whooping Cough with Congestion of Lungs	1	10m	m
Whooping Cough	3	4m, 16m, 16	m, m, f
Whooping Cough, with Pneumonia	2	10m, 18m	m, f
	190		

STATEMENT OF CONTAGIOUS DISEASES.

Diseases.	No. of Cases.	Age of Patient.	Sex of Patient.
Scarlet Fever	27	7, 12, 10, 5, 2, 4, 8, 3, 12, 4, 1, 5, 9, 10, 7, 5, 12, 6, 8, 10, 15, 8, 7, 14, 3	f, m, f, m, m, f, m, m, m f, f, m, f, m. m, m, m, m, m, f, f, m, m. f, f, m
Scarlet Fever and Diphtheria	1	6	m
Scarlatina	1	14	f
Diphtheria	24	4, 5, 4, 4, 4, 6. 12, 11, 21, 4, 6, 20, 8, 3, 6, 13, 12, 11, 8, 8. 6, 8, 12	m, m, f, —, m, f, m, m, m, f, f, f, m, —, f, m, m, f, m, m, m. m, f
Diphtheritic Scarlet Fever	3	4. 2½, 6 m.	m, f, m
Smallpox	7	25, 33, 20, 23, 30, 20, 25	f, m, m, m, m, f, m

Note.—The first letter, indicating sex, in each case belongs to the age first stated after each separate disease, the second letter to the age secondly stated, and so on.

Statement of Contagious Diseases. In addition to the above, in response to a request made by the Medical Health Officer for a report of the typhoid fever cases occurring since August 1st of this year, twenty-six cases of that disease were reported.

Report of Medical Health Officer.

Windsor, December 15th, 1902.

To the Board of Health, Windsor :

Gentlemen,—I have the honor to report to you as regards the general health of the people of Windsor, as follows :

During the present year there have been recorded 27 cases of diphtheria, with 4 deaths ; 29 cases of scarlet fever, with 1 death ; 7 cases of smallpox, with no deaths ; 26 cases of typhoid fever, with 2 deaths. The mortality for each class has been very low, the number of deaths from all causes being a mortality of 14.61 per thousand, which compares favorably with any other city in the Province.

In regard to the cases of smallpox, each was directly traced to Detroit, and considering the large amount of money expended in caring for the patients, and keeping in quarantine those exposed (a sum amounting to about $700), I would again urge you to use every effort to procure assistance from the Dominion authorities. We are certainly protecting the people back of us, and when other places receive support in the way of quarantine stations and officers, there is no good reason why an important port like Windsor should not receive the same.

The arrangements for the removal of garbage have been well and faithfully carried out by the contractor, but there remains the fact that there is room for improvement by having a more systematic arrangement in carrying out the work. I think that this could be obtained by having the work placed under the control of the Board of Works. This is a suggestion I would like you to discuss carefully, and I hope that it will meet with your approval. Although it does not come under the duties of your Board, I would suggest that convenient boxes be placed about the centre of the city for the reception of waste paper, etc. They would help materially in keeping the streets in a better condition, and the expense would amount to very little.

I wish to bring another matter before you, and that is the fact that Windsor has no hospital for contagious diseases, such as diphtheria and scarlet fever. The Hotel Dieu is unable to care for them, and the result is that such cases have to be treated at private residences, where in many cases facilities are entirely wanting, and other persons are necessarily exposed. I would ask that you take up the matter with the city council, and urge upon them the necessity of such an institution. I know that it would meet with the approval of the public, and particularly with the medical profession.

I thank you, gentlemen, for the hearty manner in which you have helped me during the year, and desire to compliment your Inspector, Mr. Greive, for his faithful and prompt attention in all cases when his services were required.

All of which is respectfully submitted.

Yours truly,
(Signed) J. A. ASHBAUGH,
Medical Health Officer.

HAMILTON

Report of Medical Health Officer.

Hamilton, December 1st, 1902.

To the Chairman and Members of the Local Board of Health :

Gentlemen,—I have the honor to herewith submit to you a report of the sanitary condition of the city, and the work of the Health Department, for the year ending October 31st, 1902:

There were 691 cases of infectious disease of all classes reported during the year. Of these 106 were diphtheria, with 24 deaths, a mortality of 22 per cent., and 44 per thousand of population. Compared with other cities, this is not a high death rate, but it is a great annual loss of life from a preventable disease. Last year there were 25 deaths. Quarantine is carried on as far as possible by this department. The difficulties met in dealing with this disease will be appreciated if you consider the following conclusions by the most eminent bacteriologists: (a) Diphtheria bacilli are found in the throats of 3 to 7 per cent. of healthy persons who have been exposed to diphtheria, directly or indirectly ; (b) such healthy individuals do not develop diphtheria as a rule, because of their actual immunity, or what is known as "antitoxic condition of their systems"; (c) in the throats of about 90 per cent. of such healthy individuals the bacilli found are virulent, or the means by which the disease is carried from place to place. When the bacilli are transferred to the throats of susceptible persons, they readily produce the disease. (d) The diphtheria bacillus usually remains in the throat of persons having had the disease for several weeks following complete recovery from illness. There is the greatest danger of transmission and infection just as long as any germs remain present. Treatment of the throat should continue until the organism has disappeared. (e) There is no clinical difference by which differential diagnosis may be made ; in the pictures of throat lesions produced by (1) streptococcus pyogenes, an organism found in erysipelas and some cases of pneumonia and several other diseases ; (2) the oidium albicans (the fungus which produces thrush); (3) true diphtheria caused by Klebs-Loeffler bacillus. The only positive means differentiating is by a bacteriological examination. As regards treatment, antitoxin is curative, if properly used in the early stages of Klebs-Loeffler (true diphtheria). The statistics indicate that the death rate from diphtheria decreases proportionate to the early administration of antitoxin. Did public opinion give us the same support in the control of diphtheria as smallpox, it would be no more prevalent. This would mean isolation in hospital of even the mildest cases ; quarantining suspects and those who have been exposed, and keeping both at the public expense, until they could go about with safety. Leaving out of account all the suffering and pain, which is beyond any estimate, it would pay any municipality to do so from a commercial standpoint. Economists estimate a life to be worth one thousand dollars to the State. If this basis be accepted, this city lost last year one hundred and forty-nine thousand dollars from death by infectious disease (including tuberculosis). The expense in treatment, nursing, and loss of wages, etc., would amount to as much more, making about three hundred thousand dollars in all. Surely it is necessary to take some effectual means of controlling these diseases.

There were 64 cases of typhoid fever reported, with seven deaths, a mortality of 13 per 100,000 population. This is low, and places the water, ice and milk supply of the city in a good position in comparison with other cities as regards freedom from typhoid. Of the 64 cases reported, 16 were found on investigation to have been infected outside of the city, most while in the country, doubtless from using impure well water. Nine in one neighborhood were traced to a common milk supply. Upon investigation this dairy was condemned, and the license cancelled.

During the year five cases of smallpox were reported. Owing to the prompt measures taken by the Board and its officials, in no instance did the disease spread beyond the first case, each of which was imported. These cases were handled at the cost of $905, less than $200 a case. For smallpox, this comparatively shows a very economic treatment. The cases, with the exception of one, were quarantined in the house where they took sick ; this happened to be effectual, but it is a poor makeshift, and will not always be successful ; moreover, it cannot always be adopted. The Board assumes a heavy responsibility in so doing. The year closed without a proper isolation hospital, or even a site. Four of these cases had never been successfully vaccinated, and one not since childhood, and in this case the attack was mild. With the exception of about 50 persons, who were exposed to infection from these cases, I have not done any vaccinating during the year, no one having applied, and I believe there has been very little done in the city. Judging by the past experience, unless smallpox keeps recurring every year, it is probable that some years will elapse without vaccination to any extent, until another outbreak, when there will be a rush. Under such circumstances this delicate little operation is hurriedly and imperfectly done, with the result of either imperfect inoculation or an infected arm. Years ago, when the ravages of smallpox were more evident than they are now, vaccination was almost always done in infancy. Children were taken to the vaccinator as religiously as to be baptized. Every child should be vaccinated before reaching school age. The operation not only gives less annoyance then, but it will be better done, and, moreover, there will be no loss of time from school or occupation. A systematic method of accomplishing this is required.

The other infectious diseases reported are : Scarlet fever, 97 cases, with three deaths ; chickenpox, 74 cases ; mumps, 11 cases, and no deaths ; measles, 222 cases, with 2 deaths : whooping cough, 112 cases, and 13 deaths, all in infants. This disease was very prevalent last winter, and many cases were never reported, but the mortality shows it is not a trifling disease. It is a difficult disease to keep from spreading, as the attack often lasts three months or more, during which time the patient is infectious. Again, patients are advised by physicians to keep in the open air, as it is better for their convalescence, but it is not for their playmates. Three months is a long time to be kept from school, and to avoid this, parents, when they do not have a physician, conceal the trouble, and allow children to go to school before free from infection. All pupils absent from school a week should be required to produce a certificate from a physician that they are free from infection. This measure would not only aid in preventing the spread of these milder infectious diseases, but would indirectly secure a more regular attendance.

Seventy-six cases of diphtheria, 18 of scarlet fever, and 32 of typhoid fever were treated at the City Hospital during the year. For diphtheria this was 72 per cent. of all reported cases. The hospital is being taken advantage of more every year for the treatment of this disease, and that is as it should be. In houses of one story, of which there are so many in the city, it is impossible to satisfactorily isolate cases of diphtheria and scarlet fever. To remove them to the hospital, not only removes the source of infection from the house, but patients can be better treated there.

Mortuary Statistics. Excluding 47 still births, which are not counted in mortuary statistics as deaths or births, 744 deaths have been recorded at the Registrar's office during the past twelve months. The Assessor's enumerations gives us a population of 54,030, thus showing a death rate of 13.7 per thousand. This is a low rate, and indicates good sanitary conditions. The death rate of last year was 14.5 per thousand, showing a decrease of nearly one per thousand. There was also less sickness of a general non-fatal character than usual.

Of 744 deaths, 366 were males and 378 were females, nearly an even number.

There were 137 deaths under one year of age, 18½ per cent. of the total mortality; premature births, of which there were 25, unsanitary surroundings, and improper food are the chief factors in the causation of infant mortality. There were 20 deaths from cholera infantum and other diarrhoeal diseases. One hundred and sixty-five persons reached three score years and ten, over 22 per cent. Sixty-six lived to be 80 years of age, and nine over 90, the oldest being 109 at the time of death. Fourteen deaths were recorded of inmates of the House of Refuge, 10 at the Infants' Home, 3 at St. Mary's Orphanage Asylum, 3 at Aged Women's Home, 1 at City Jail (a non-resident, from tuberculosis). Twenty-five deaths occurred from accident, including three from gas poisoning. Among the general causes of death were 45 from cancer, 85 from diseases of the heart, mostly in the aged: 84 from phthisis, and 21 from other forms of tuberculosis, making 105 from this disease.

An important measure to lessen the ravages of tuberculosis was taken when the City Council, on the recommendation of the Board of Health, passed the following by-law: "Every medical practitioner, practising within the municipality, shall report to the Medical Health Officer upon one of the forms supplied by him for the purpose, every case of pulmonary tuberculosis which he attends, or is called upon to visit in the City of Hamilton: such report to be made within one week after he knows that his patient has such disease: and shall also, if the patient dies from such disease, report the death to the Medical Health Officer within twenty-four hours after it takes place.

When cases are notified, what sanitary measures are proposed for the prevention of the disease, I would recommend, (1) Inspection of the pre mises, preferably by a medical officer, giving personal instruction to patients as to proper disposal of sputum, at home, when at work, and when travelling, and as to the cleansing and disinfection of the house at frequent intervals, and leaving printed information of a non-alarmist character in regard to the disease, and the method of its extension. He should attend to any indirect cause of the disease, and which would be conducive to its spread ; for example, the lighting, ventilation, and dampness of houses, milk supply, etc.

Information should be gained for investigation purposes, which, though not useful to a sufferer, enables lines of new action to be worked out. A schedule should be prepared to tabulate inquiry as to duration of illness, the period of stay in the house, the amount of isolation (if any) carried out, the sanitary condition of the house, including overcrowding, if it exists; the family history, in regard to tuberculosis; the place of work, the previous medical history of the patient. Effort should be made to discover the source of infection, by questioning the patient as to the existence of consumption in relatives, companions, or work-fellows. This investigation should take place at the patient's home; the office, workshop, or factory should also be visited, but in a general way, without any reference to the special case, care being taken to remove any sanitary defects, uncleanliness, or dust, nuisance.

2. Monthly visits by inspectors, to see that preventive measures are being carried out.

3. The disinfection and renovation of all premises vacated by death of consumptives. When required and practical, the employment of the same measures during life. Attending physicians should be required to notify the health department when a patient changes his abode, unless they can certify there had been no recent infectious discharges, rendering disinfection and cleansing necessary, before the vacated rooms are occupied by a new tenant. I believe more in renovation, such as kalsomining, lime washing of ceilings, repapering, and washing floors and furniture with plenty of soap and water, rather than depending wholly on any means of disinfection.

4. Literature having no official heading should be distributed to physicians, who would give it to patients where advisable.

5. The removal of the patient.

(a) Incipient Cases: Among the poor encouragement should be given them to take advantage of the arrangements made by the City Council for treatment at the Gravenhurst Sanitarium. Every case cured diminishes the amount of infection, and will be a valuable educational factor in the community. Those who are not cured will have learned, in a way that can be best taught in institutions, how to take proper care of their sputum.

(b)) For Advanced Cases: Unable to work, and willing to go, a hospital or home should be provided, either in a separate ward of the general hospital, or, better, in a properly equipped building, in the country, adjacent to the city. It is advocated that temporary treatment should be offered to a rapid succession of phthisical patients in municipal hospitals, suitable for patients who are living under unfavorable conditions at home, or who are a source of risk to his family, and to those with whom he works. The cure of these patients is not anticipated, but in the interest of the public health, it is intended to care for them, for a short period of time, a month or two, with the following objects in view : (1) The patient himself will be improved, and enabled to start afresh, with better prospects of recovery. (2) While in the municipal sanatorium, his house will be cleansed and disinfected, and his relatives will be freed from uninterrupted exposure. (3) The patient, when sent home, will have been taught to so manage his expectoration that he will be no longer a source of risk to his family, and to those with whom he works.

I would recommend that special forms, which can be sealed, differing in color and shape from those used in the case of contagious diseases, be supplied physicians, for reporting tuberculosis, and these are not to be opened by any one in the health office, except the Medical Health Officer, and the register kept for future reference must be kept under his own personal supervision. It is also my opinion that no action should be taken, except registration, where physicians instruct the patient and the family in the proper method of disposal of sputum, in other means, to prevent infection and will distribute literature to the family, which will be supplied him. I would also require him to notify the Health Officer of a change of address, so that the apartments can be renovated and disinfected. In the report required from physicians, I would have this question: Do you wish an inspector to visit the premises, and instruct the family regarding prophylaxis? Answer, Yes or No. Cases would not be visited by an inspector from the health office except on the request of the family physician, the understanding being, if he do not request it, he will adopt and supervise the necessary measures himself. There is a certain class of people over whom a physician could have no control: the sanitary authority should here be called to assist. Among the poor, the class in which tuberculosis is most frequent, often the necessary means of preventing the spread of infection are absent, and the municipality should be called upon to supply them. In some cities of England, the consumptive poor are gratuitously supplied with sputum bottles and Japanese handkerchiefs, and it has been the experience there that they readily avail themselves of these means of prevention. Sanitary measures are mostly needed among the poor, where bad ventilation and over-crowding exists. Judicious discrimination should be used in carrying out regulations adopted for prevention of tuberculosis. No reasonable sanitary officer would expect to put into force regulations requiring the notification of tuberculosis with the same conditions and in the same way that a similar one in regard to smallpox or diphtheria would be enforced. The process of the enforcement of such a law must be developmental, and it must be distinctly understood, and strongly and constantly emphasized, that tuberculosis is a different kind of disease from smallpox and scarlet fever, or any of the highly contagious diseases.

The water and ice supplied the city have been several times analyzed, during the year, at the laboratory of the Provincial Board of Health, and found to be of good quality.

Four hundred and five samples of milk were tested during the year. The average percentage of butter fat of all samples collected was 4.05, showing that there is no ground for complaint, as to the richness of the milk, generally. In the early part of the year tests were made for coloring matter put in milk, for the purpose of giving it an artificial appearance of richness. Three milkmen were prosecuted and fined; since which time, every sample collected has been tested for "annatto," but none found.

The scavenger system continues to give fair satisfaction, judging by the scarcity of complaints. These have been investigated promptly by the inspectors, and usually the trouble has arisen through a misunderstanding as to the proper time and day of call by the scavengers. In some cases, receptacles have been too dilapidated for handling, and in others too large and heavy. One hundred pounds should be a limit for a scavenger to be asked to lift; that must get very heavy toward the end of a long day. The bi-weekly collection during the summer months was taken more advantage of by the citizens than last year. The streets, lanes, and alleys have been kept cleaner this year than usual. Street dust is an important factor in the causation of diseases of the respiratory tract.

I append a report of work done by the Sanitary Inspectors, and tables and maps, showing the distribution of infectious diseases. You will see that they have occurred in an isolated way throughout the city. I would also call your attention to the small number of instances in which there has occurred more than one case in the same house.

All nuisances complained of during the year have been promptly investigated and attended to by the inspectors. I wish to commend them for good work in discharge of their several duties.

Respectfully submitted.

WALTER F. LANGRILL,
Medical Health Officer.

Report of Sanitary Inspector.

Hamilton, 8th November, 1902.

To Dr. W. F. Langrill, Medical Health Officer :

Sir,—Below please find synopsis of work done by your three Inspectors from the 1st day of November, 1901, to the 31st day of October, 1902, inclusive.

Yours respectfully,
(Signed) L. A. MacDONALD,
Inspector.

Number of inspections made	5,747
Number of privy vaults notified to be cleaned	438
Number of privy vaults, permits for new ones	1
Number of privy vaults, issued to contractors to clean	1,020
Number of privy vaults abolished	91
Number of cesspools notified and cleaned by contractors	25
Number of cesspools abolished	19
Number of dry earth closets to clean	36
Number of sewer connections to make	114
Number of sewer connections made	71
Number of sewer connections found defective	87
Number of stagnant water, to abolish	13
Number of dirty premises to clean	42
Number of other nuisances to abate	475
Number of old wells to fill in	5
Number of houses placarded	142
Number of houses fumigated	246
Number of milk samples collected and tested	405
Number of licenses issued	183
Number of complaints unfounded	1

Work Done by Your Scavengers.

Number of team loads of garbage and refuse collected	10,662

Burnt at Crematory.

Number of dogs	451
Number of cats	305
Number of fowl	48
Number of fish, barrels and boxes	27
Number of goats	1
Number of loads of used rags, etc., from City Hospital	85
Number of loads of bedding from infected houses	10
Number of rabbits	2

Summary of Infectious Diseases from Nov. 1, 1901 to Nov. 1, 1902.

Disease.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Total.
Scarlet Fever.	14	14	16	19	10	5	4	6	0	1	2	6	97
Diphtheria . .	11	21	13	9	16	5	4	3	5	1	8	10	106
Typhoid Fever	3	2	1	1	2	1	0	3	2	17	29	3	64
Chickenpox ..	8	17	0	11	16	8	7	3	2	0	0	2	74
Smallpox	.....	.....	2	.....	1	1	1	......	...	.....	.....	...	5
Measles	1	3	7	8	28	85	52	35	1	1	1	0	222
Whooping Cough	0	7	36	41	12	9	3	0	3	1	0	0	112
Mumps	.....	..	1	.	1	2	2	1	....	.....	3	1	11

Table showing Deaths from Infectious Diseases by Months.

Diseases.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Total.
Diphtheria ...	4	3	3	3	3	1	2	1	1	1	1	1	24
Scarlet Fever.	.....	...	.....	1	2	......	......	...	....	...	......	...	3
Typhoid	2	1	......	......	......	...	....	.....	.....	2	1	1	7
Pulmonary Tuberculosis	3	9	4	10	8	8	8	8	2	9	9	6	84
Whooping Cough	1	......	1	1	3	1	.....	5	....	1	.....	.....	13
Measles	......	......	......	.....	......	..	.....	1	1	...	....	....	2

Summary of work done by Inspectors in Quarantine and Disinfection.

	Diphtheria.	Scarlet Fever.	Smallpox.	Tuberculosis.	Chickenpox.	Typhoid Fever.	Whooping Cough.	Total.
Houses placarded...	75	67	2	0	0	0	0	144
Placards removed...	75	67	2	0	0	0	0	144
Houses disinfected..	103	84	13	20	7	0	1	228
Inspections made while under quarantine........	120	147	16	0	4	30	1	318
Defects in sanitation found	8	0	1	1	0	8	0	18

TABLES COMPILED FROM THE ANNUAL REPORTS OF LOCAL BOARDS OF HEALTH.

Cases and Deaths from Contagious Diseases by Municipalities for year 1902.

Cities.	Small-pox.		Scarlatina.		Diphtheria.		Typhoid.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Belleville	...	...	...	...	2	..	5	...
Brantford	2	...	37	...	72	12	43	4
Chatham	43	...	42	1	7	3	55	5
Hamilton	5	...	97	3	106	24	64	7
Kingston	...	...	31	...	63	3	17	4
London	...	...	...	...	...	20	3	3
Ottawa	300	2	689	50	230	28	...	22
Stratford	...	...	11	...	9	...	29	1
St. Thomas	...	...	24	...	4	1	...	...
St. Catharines	1	...	12	...	6	1	32	5
Toronto	28	...	701	88	893	115	130	25
Windsor	5	...	30	3	17	3	26	2
Woodstock	2	...	...	2	...	2	...	3
Guelph	...	...	24	...	14	2	16	...
Towns and Villages.								
Acton	5	...	12	...	...	...	...	...
Alvinston	...	...	7	...	...	...	...	...
Arkona	...	...	2	...	...	...	...	...
Aylmer	...	...	...	...	...	...	...	...
Aurora	...	...	...	...	...	...	...	...
Athens	...	...	...	...	...	...	...	...
Alliston	...	...	...	...	...	2	...	...
Arnprior	...	...	3	...	4	...	3	2
Arthur	...	...	...	...	...	...	...	...
Ashburnham	...	...	6	...	15	6	1	...
Alexandria	3	...	3	...	30	5	3	...
Ailsa Craig	1	...	...	...	3	1	...	...
Bracebridge	...	...	10	1	6	...	1	1
Beamsville	...	...	...	...	2	1	...	...
Barrie	1	...	5	..	2	1	...	4
Berlin	2	...	21	1	12	2	4	4
Bath	...	...	...	...	3	1	...	...
Bayfield	...	...	...	...	...	...	2	...
Beaverton	...	...	...	...	...	...	...	...
Beeton	...	...	...	...	...	...	...	..
Belle River	...	...	...	...	20	2	...	...
Bolton	...	...	...	...	...	...	...	...
Brampton	...	...	11	...	7	2	...	...
Brighton	...	...	...	...	...	...	...	...
Brockville	25	...	30	...	49	3	29	3
Bowmanville	...	...	2	1	20	2	2	...
Bothwell	...	...	...	...	...	...	...	...
Brussels	...	...	...	...	7	3	4	1
Burk's Falls	...	...	...	...	...	...	30	1
Burlington	...	...	...	...	...	...	...	...
Bridgeburg	...	...	...	...	...	...	...	...
Blyth	...	...	...	...	...	...	...	...
Bobcaygeon	...	...	...	...	...	...	6	...
Campbellford	...	...	1	...	2	...	...	...
Cobden	...	...	...	...	...	...	...	...
Creemore	...	...	1	...	...	...	...	...
Cobourg	...	...	4	...	1	1	4	1
Cayuga	...	...	1	...	1	..	1	...
Caledonia	...	...	...	...	...	...	...	...
Cannington	...	...	...	...	2	...	2	1
Chesterville	...	...	...	...	...	...	...	...
Clinton	...	...	10	...	..	...	4	...
Cornwall	19	...	...	...	5	1	20	4
Colborne	...	...	...	...	...	...	...	1
Carleton Place	7	...	2	...	...	...	...	1
Chesley	...	...	24	2	...	...	...	...
Chapleau	...	...	3	...	...	...	...	...
Chippawa	...	...	...	...	...	...	...	...
Collingwood	...	...	1	1	4	4	2	2

Towns and Villages.	Small-pox.		Scarlatina.		Diphtheria.		Typhoid	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Copper Cliff	12	...	...	...	9	...	...	...
Clifford	...	...	15	...	...	...	3	...
Delhi	...	...	...	...	...	...	...	...
Dresden	...	...	7	1	...	...	4	...
Durham	...	...	4	...	4	1	2	...
Dunnville	...	...	...	...	...	...	1	1
Dundalk	...	...	...	...	...	...	...	...
Deseronto	1	...	...	...	1	1	...	...
Drayton	...	...	...	...	...	...	...	...
Dutton	2	...	...	...	...	...	..	...
Eganville	...	...	...	...	...	...	...	...
Elora	...	...	...	...	...	...	...	...
Erin	...	...	2	...	5	...	...	...
East Toronto	...	...	...	...	...	...	...	...
Elmira	...	...	3	...	...	...	2	...
Embro	...	...	...	...	7	...	...	...
Exeter	...	...	...	...	2	1	...	...
Forest	...	...	...	...	...	...	...	..
Fort Erie	...	...	...	...	...	...	3	...
Fort William	...	...	70	13	...	...	50	4
Fergus	...	...	1	...	...	...	...	..
Galt	1	...	5	...	45	...	19	1
Garden Island	...	...	...	...	...	...	...	...
Gore Bay	...	...	...	...	...	..	...	...
Grand Valley	...	...	...	...	1	...	...	...
Gananoque	...	...	...	...	1	1	...	1
Georgetown	...	...	...	...	...	...	...	...
Hagersville	...	...	1	...	.	..	...	...
Hanover	...	...	..	...	6	1	...	...
Hastings	...	...	...	...	...	...	...	...
Hawkesbury	48	...	...	...	...	..	...	1
Hespeler	...	...	...	...	...	...	...	...
Hensall	...	...	...	...	...	...	...	...
Hintonburgh	30	...	87	7	5	1	...	...
Holland Landing	...	...	...	...	...	...	...	...
Huntsville	...	...	...	...	2	...	...	..
Harriston	..	...	...	...	...	...	2	...
Havelock	...	...	...	..	...	...	...	...
Iroquois	...	...	...	...	...	...	...	...
Kincardine	..	...	...	...	...	..	1	...
Kingsville	...	...	...	...	...	...	..	...
Kemptville	...	...	...	...	...	...	...	...
Lancaster	...	...	...	...	...	...	...	...
Leamington	...	...	...	...	3	..	9	...
Little Current	...	...	...	...	...	...	4	1
L'Orignal	12	...	...	...	3	1	...	...
Listowel	...	...	...	...	35	2	1	...
Lakefield	...	...	7	1	...	...	...	...
Lindsay	...	...	31	10	8	...	10	...
Lucknow	...	...	...	...	...	...	...	...
Mattawa	2	...	10	...	...	...	8	1
Millbrook	...	...	6	...	...	...	7	1
Milton	...	...	8	..	...	...	...	...
Mitchell	...	...	...	...	...	...	...	...
Milverton	...	...	...	...	...	...	...	...
Mount Forest	...	...	4	1	5	1	6	...
Madoc	...	...	...	...	...	...	...	...
Markham	...	...	...	...	1	1	...	...
Meaford	...	...	...	...	...	...	...	...
Merrickville	...	...	...	...	4	...	1	...
Merritton	...	...	...	...	.	...	...	...
Morrisburg	...	...	...	...	...	...	...	...
Markdale	...	..	...	...	1	1	...	...
Newcast'e	...	...	...	...	4	...	...	...
Niagara Falls	...	...	...	...	...	...	3	...
North Toronto	...	...	...	...	2	...	2	...
Norwood	...	...	...	...	10	...	...	...

Cases and Deaths from Contagious Diseases by Municipalities.—*Continued.*

Towns and Villages —*Con.*	Small-pox.		Scarlatina.		Diphtheria.		Typhoid.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Norwich	34		1				13	1
New Hamburg								
Newburgh			13				1	
Newmarket			3	1			1	1
Napanee			3		7			
Niagara			2				6	
North Bay	1			7				
Oakville								
Orangeville								
Oshawa			12		12	2		3
Ottawa, East	2		3		5	1		
Owen Sound			2		2		46	3
Omemee								
Parry Sound	26		12		6		3	
Peterborough	2		100	15	22	5		
Preston							1	1
Point Edward	2	1						
Parkhill			1					
Paisley	3		3		2			
Palmerston								
Portsmouth							1	1
Petrolia			10	1			12	1
Prescott			38	2			7	
Pt. Colborne								
Pt. Dalhousie								
Pt. Dover			4				3	
Pt. Elgin			1				3	
Pt. Perry							1	
Pt. Rowan								
Pt. Stanley			27	1				
Pt. Arthur	1		30		41	6	209	11
Pt. Hope			2		25	2	6	2
Perth	20							1
Paris								
Pt. Carling								
Pembroke	30		12		4		5	1
Renfrew								
Ridgetown								
Richmond Hill							2	1
Rockland	25							
Sandwich					1			
Shelbourne	1		4				1	
Seaforth							3	
Simcoe	1				1			
Smith's Falls	10		2				3	
Springfield					3		6	1
Stouffville			2					
Strathroy								
Streetsville								
Sturgeon Point								
Sundridge	1							
Southampton								
Sault St Marie	4		12	2	3			
Sarnia	8		1		1			13
Stirling								
Sturgeon Falls							4	2
Sutton							1	
St. Mary's			6					
Sudbury	19		9		6		12	
Tiverton								
Toronto Jct			6	2	21	3		3
Tara								
Teeswater			1				2	
Thedford					1	1		
Thessalon							12	
Thorold			1		7	1	3	
Tilsonburg					1		12	

Towns and Villages.—*Con*	Small-pox.		Scarlatina.		Diphtheria.		Typhoid.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Tilbury	1				2	1		
Tweed			2		1			
Thamesville	1							
Thornbury								
Tottenham					2	1		
Uxbridge							6	6
Vankleek Hill	1							
Vienna								
Walkerton	3						8	
Walkerville			6		5	1	1	1
Waterdown							2	
Wellington								
Whitby			2		2			
Winchester	1		1					
Woodbridge								
Woodville					1			
Wroxeter							1	
Welland			8		4			
Wiarton			1		2			
Waterford								
Weston								
Wingham			2		15	5		
Wyoming								
Waterloo	4		15		1		4	1
Wardsville							1	
Townships.								
Adelaide			2					
Admaston								
Alfred	35		75	6	22		6	1
Alnwick			2					
Ameliasburgh								
Amherst Island								
Ancaster			3	1				
Arran								
Arthur			3		2	1		
Ashfield								
Assiginack	19						1	
Athol								
Augusta			2					
Anderdon	3		7		3	1	1	1
Albion								
Anson & Hindon					8			
Albermarle								
Armour								1
Aldborough								
Atwood					35	3		
Alice & Fraser	32							
Barton							2	
Bastard & B.								
Bathurst	9	1						
Bangor, etc	3		1	1				
Bagot & B					1	1		
Bedford	8							
Bentinck			2		2	2		
Bexley								
Biddulph								
Bertie			2					
Beverly							3	
Binbrook	19							
Blandford			5					
Blanshard			5		1		2	
Blenheim			4	1	4		12	
Beckwith							1	1
Blind River								
Bondfield	3							

Cases and Deaths from Contagious Diseases by Municipalities for 1902. *Continued.*

Townships.	Small-pox.		Scarlatina.		Diphtheria.		Typhoid.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Bosanquet	....	....	4	..	....	..	..	..
Brock	..	....	8	1	4	1	12	1
Brant	4	...	7	....	3	.	....	.
Brantford	....	....	2	....	10	1	2	2
Brighton	....	....	20	..	....	.	15	..
Burleigh & A.	....	....	....	....	7	2	....	.
Brooke	1	....	...	....	....	..	....	.
Burgess, N.	....	....	....	....	...	..	....	..
Burford	1	....	2	....	5	..	2	..
Buck	....	....	....	....	....	..	...	..
Brudenell & L.	2	....	....	....	....	..	..	.
Bruce	8	....	....	1	....	.	12	1
Brunel	....	....	2	....	1	..	.. .	..
Bayham	....	....	....	....	1	..	8	..
Belmont & M	....	....	....	....	....	..	....	..
Billings	....	....	....	....	....	..	....	..
Brougham	....	....	....	....	....	..	....	..
Caldwell	....	....	6	....	...	..	....	..
Caledon	....	....	12	.. .	8	..	....	..
Caledonia	....	....	....	....	..	..	1	1
Cambridge	....	....	....	....	...	..	...	..
Camden, W.	7	....	....	....	....	..	..	..
Cameron	....	....	....	....	....	..	....	..
Canborough	....	....	2	....	1	..	7	1
Caistor	8	....	....	....	....	..	12	..
Clarence	1	....	....	....	....	..	1	1
Caradoc	23	....	....	....	2	.	2	..
Cardiff	....	....	....	....	..	..	....	
Carrick	4	....	1	1	1	..	3	..
Carling	....	....	....	....	....	..	....	..
Carlow	....	....	2	....	....	..	....	..
Calvin	....	....	....	....	...	..	....	..
Cavan	....	...	6	1	3	..	....	..
Cayuga, N	....	....	..	....	....	..	1	1
Chaffey	....	....	....	....	....	..	1	1
Chapman	....	....	21	....	..	..	2	..
Chapple	....	..	....	....	....	..	....	.
Charlottville	....	....	....	....	....	..	...	..
Chandos	....	....	..	....	....	..	...	..
Charlottenburg	94	1	4	....	1	..	2	..
Christie	....	....	....	....	2	1	....	..
Clarke	....	....	....	....	1	..	...	..
Colchester, S.	....	....	10	...	20	2	5	..
Cornwall	7	....	....	...		..	...	.
Colborne	...	....	...	....	....	..	...	..
Crowland	....	....	3	....	1	..	....	..
Culross	....	....	...	....	....	.	...	..
Cumberland	10	....	10	....	4	..	3	..
Camden, E.	3	...	6	1	3	..	4	.
Cartwright	....	....	....	1	....	..	....	..
Carden	....	....	....	....	....	..	....	..
Cayuga, S	.. .	....	....	....	....	..	....	..
Chingacousy	....	....	....	..	....	..	....	..
Clarendon & M.	....	....	....	....	2	..	...	..
Colchester, N.	....	....	....	....	2	..	...	..
Cockburn Is'd.	..	....	....	....	....	.	...	..
Carnarvon	...	....	....	....	....	..	....	..
Crosby, N	...	....	....	....	..	..	...	..
Dereham	21	....	....	....	2	1	....	..
Dummer	....	....	1	1	3	3	....	.
Dalhousie & N.S	...	....	....	....	....	..	....	..
Dalton	...	....	....	....	....	..	...	..
Darling	....	....	....	....	....	..	....	..
Darlington	....	....	7	....	....	..	5	4
Dawn	..	....	....	....	....	..	1	.
Day, Gladstone, etc	...	.. .	....	...	....	..	....	..

Townships.	Small-pox.		Scarlatina.		Diphtheria.		Typhoid.	
	Cases.	Deaths.	Cases	Deaths.	Cases.	Deaths	Cases.	Deaths.
Delaware	...	...	6	....	....	.	1	..
Denbigh A.& A.	...	...	....	2	....	2	....	..
Derby	...	..	....	....	....	..	....	..
Dorchester, N.	....	....	16	....	1	.	3	..
Douro	...	....	....	....	....	..	....	..
Draper	8	..	....	....	....	..	....	..
Drummond	6	....	...	....	....	..	..	..
Dover	390	2	4	....	...	..	1	1
Dumfries, N.	....	....	3	....	6	..	2	..
Dunn	....	....	...	....	. .	..	....	..
Dumfries, S	...	....	...	....	6	..	1	1
Dymond	....	....	13	1	....	..	....	..
Dungannon		...	....	....	..	..	...	..
Dysart	....	....	3	...	21	4	2	..
Dorchester, S.	....		....	....	....	.	....	..
Downie	....	....	....	....	....	.	2	..
Easthope, S	...	....	....	....	....	..	....	..
Edwardsburg	...	....	.	....	...	2	....	..
Egremont	2	....	....	....	6	1	....	..
Elma	1	.	....	...	4	1	30	1
Elderslee	....	....	...	....	....	..	....	..
Ellice	...	....	...	...	....	..	....	..
Elmsley, S.	3	....	..	...	....	..	....	..
Etobicoke	1	....	9	1	1	..	6	2
Emily	....	...	8	....	8	2	...	..
Enniskillen	...	....	...	....	....	..	....	..
Ernesttown	1	...	1	...	5	..	5	..
Erin	....	....	....	...	...	..	2	..
Essa	....	....	...	...	....	.	..	..
Esquesing	3	....	3	..	1	.	1	..
Euphrasia	1	....	...	....	...	..	....	..
Eramosa	...	...	1	...	1	..	....	.
Eastnor	....	...	....	...	....	.	....	..
Elmsley, N	2	....	.	....	...	.	....	..
Elzevir	....	....	1	....	...	.	....	..
Euphemia	..	....	...	....	....	..	....	..
Ekfrid	11	....	3	...	3	1	....	..
Emo	2	....	....	...	....	..	....	..
Ennismore	...	....	12	....	5	1	...	..
Elizabethtown	....	....	....	...	1	..	2	..
Fredericksburg, N	....	....	...	...	2	..	....	..
Fredericksburg, S	....	....	.	....	...	..	....	..
Fullerton	...	....	....	...	...	..	2	..
Finch	43	....	....	....	....	..	....	..
Fenelon	...	....	...	....	....	..	..	..
Fitzroy	6	....	4	....	...	..	....	..
Flamboro, E	6	....	....	....	1	1	....	..
Flamboro, W.	...	....	....	....	...	..	....	1
Floss	3	....	....	...	3	1	....	..
Faraday	...	....	....	....	....	..	....	..
Ferris	20	....	...	....	...	..	....	..
Foley	2	....	1	....	....	..	....	..
Gainsboro	....	....	20	....	....	..	....	..
Galway & C.	....	....	...	....	....	..	....	..
Garafraxa, W	...	....	...	....	....	..	....	..
Georgina	...	..	....	....	....	..	....	..
Glanford	...	...	....	....	..		....	..
Gloucester	59	....	25	....	40	5	....	..
Gosfield, S	....	....	....	....	...	..	1	..
Glenelg	....	....	....	...	....		1	..
Grantham	. ..	....	1	1	....	..	....	.
Grattan	....	....	....	....	10	1	....	..
Grey	....	....	....	...	....	.	....	..
Gosfield, N	....	....	....	....	2	1	3	.
Gower, N	3	....	3	....	1	..	1	..

Cases and Deaths from Contagious Diseases by Municipalities for 1902.—*Continued.*

Townships.	Small-pox.		Scarlatina.		Diphtheria.		Typhoid	
	Cases.	Deaths	Cases.	Deaths.	Cases	Deaths.	Cases.	Deaths.
Goulbourne	19	...	6	1	...	..	1	1
Grimsby, N	...	...	...	...	...	..	2	..
Grimsby, S	...	...	...	...	...	..	...	..
Guelph	...	...	3	...	1	..	1	..
Goderich	...	...	...	...	...	..	...	..
Gwillimbury, W	...	...	...	1	...	..	...	..
Gwillimbury, E.	...	...	1	...	...	..	1	..
Gower, S	...	...	...	...	...	..	...	..
Gwillimbury, N.	...	...	...	...	...	..	...	.
Gordon	...	...	...	...	...	..	...	..
Greenock	3	...	5	2	4	..	1	1
Garafraxa, E.	1	...	...	...	...	..	...	..
Griffith & M.	...	...	...	...	10	4	...	..
Glamorgan	...	...	...	...	...	..	...	..
Haldimand	...	...	13	...	5	2	5	..
Hagerman	...	...	1	...	...	..	...	.
Hay	...	...	...	...	1	..	...	..
Harvey	...	...	...	...	9	1	...	..
Harwich	10	...	...	...	..	..	...	..
Hawkesbury, E.	27	...	14	...	...	..	2	..
Head, Clara & M	...	...	...	...	...	..	..	..
Hilton	...	...	...	...	...	..	...	..
Hillier	...	...	...	..	...	2	...	..
Himsworth, S.	2	...	1	...	1	..	2	..
Horton	1	...	...	...	1	..	...	..
Howland	...	...	...	...	...	..	...	..
Humberston	...	...	...	...	...	..	...	..
Hullett	..	...	...	...	...	..	...	..
Huntingdon	...	...	...	...	...	..	..	..
Huron	...	...	...	...	...	..	...	..
Hamilton	...	...	..	...	5	2	4	..
Hawkesbury, W	1	...	...	...	...	..	...	..
Howick	...	...	...	1	...	..	...	..
Hallam	...	...	...	...	...	..	...	..
Himsworth, N	1	...	..	...	1	..	...	..
Hungerford	...	...	...	...	6	1	3	..
Hinchinbrook	1	...	...	...	...	..	1	1
Himsworth, S.	1	...	...	...	...	..	1	..
Hope	...	...	10	...	2	1	4	1
Houghton	...	...	2	2	...	..	...	..
Humphrey	.7	...	...	...	...	..	3	1
Hibbard	...	...	1	...	...	.	..	..
Innisfil	...	...	...	...	...	..	...	..
Joly	...	...	...	...	...	.	...	..
Jocelyn	...	...	...	...	...	..	...	..
Johnson & T	2	...	...	...	...	..	...	.
Keewatin	1	...	12	...	...	..	...	..
Kaladar, etc.	...	...	...	...	...	..	...	..
Keppel	...	...	...	...	...	..	...	..
King	3	...	...	...	...	..	...	..
Kingston	...	...	...	..	...	..	..	..
Kincardine	32	...	...	...	...	.	2	..
Kinloss	10	...	...	...	7	..	...	..
Kenyon	15	...	12	...	28	..	...	..
Kennebec	...	...	1	1	...	..	...	..
Kitley	...	...	...	...	...	..	...	..
Lavant	...	...	...	...	...	..	...	..
Laxton, D. & L.	...	...	...	...	...	..	...	..
Leeds & Lans. F	...	...	...	...	...	..	...	..
Logan	2	...	...	...	...	..	...	..
Lindsay, & St. Ed	...	...	...	...	...	..	...	..
Limerick	...	...	...	...	...	..	..	..
Louth	...	...	...	...	...	..	12	3
Luther, E	...	...	...	...	...	..	...	..
Luther, W	...	...	...	...	2	..	...	..
London		...	...	...	1	1	...	..
Lanark	...	...	...	...	...	..	...	..

Townships	Small pox.		Scarlatina.		Diphtheria.		Typhoid.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Lancaster	9	...	1	...	...	..	...	..
Laurier	...	...	...	..	...	.	..	..
Lobo	...	...	...	...	...	..	...	..
Lount	...	...	...	...	..	..	...	..
Laird	..	...	...	...	...	..	...	..
Lochiel	130	1	..	...	3	..	...	..
Macaulay	...	...	5	5	.. .	..	...	..
Machar	1	...	...	...	...	..	...	..
Maidstone	...	...	...	...	1	1	...	..
Matchedash	...	...	...	...	1	..	...	..
Malahide	...	...	1	1	2	1	...	..
Malden	...	...	...	...	...	..	..	..
Mara	...	...	.	...	...	..	1	..
Manvers	...	..	13	...	4	..	...	..
Mosa	3	...	...	...	...	..	...	..
March	...	...	10	1	...	..	2	..
Mariposa	...	...	1	...	5	.	...	..
Marmora & L	...	...	...	...	1	1	6	2
Mattawan	...	..	..	...	..	..	...	..
Mayo	...	..	8	...	...	..	...	..
Melancthon	...	...	3	...	...	..	...	..
Mersea	...	...	,7	...	5	1	10	..
Metcalfe	...	...	...	...	...	..	...	..
Middleton	...	...	...	...	...	..	...	..
Minto	..	...	...	...	...	..	...	..
Monaghan, N.	...	...	...	...	...	..	...	..
Mono	...	...	2	2	...	..	...	..
Moore	1	...	2	1	3	.	6	2
Monck	..	...	...	...	...	..	...	..
Murry	...	...	1	1	1	1	1	1
Monmouth	...	..	...	...	1	..	...	..
Matilda	...	...	...	...	...	1	...	1
Moulton	...	...	...	...	...	..	...	..
Mornington	...	..	...	...	...	..	...	..
Muskoka	...	...	...	...	1	..	...	..
Mulmur	...	...	3	3	2	..	...	..
Medora & W.	...	...	...	...	..	..	3	..
Mountain	...	...	...	...	1	1	...	..
Marlborough	1	...	...	...	...	..	...	..
Madoc	1	...	...	...	...	..	...	..
Morris	...	...	...	...	1	1	...	..
McMurrich	...	...	1	...	...	..	...	..
McDonald & M.	15	...	...	...	...	..	...	..
McIrwin	1	...	4	1	6	..	2	..
McDougal	...	...	1	1	...	..	...	..
McKillop	...	...	...	...	...	..	...	..
McLean & R.	...	...	2	2	...	..	...	..
McKellor	...	...	...	...	...	..	...	..
McGillivray	3	...	5	...	...	..	...	..
McNab	13	...	...	...	5	2	1	1
Marysburgh, S.	..	...	...	...	1	..	...	..
Marysburgh, N.	...	...	...	...	1	..	...	..
Monaghan, S.	...	...	...	...	...	..	...	..
Minden	...	...	4	...	1	.	...	..
Medonte	...	...	25	...	1	1	1	..
Montague	2	...	...	...	...	..	...	..
Nairn & Lorne	...	...	...	...	...	..	...	..
Neebing	...	...	6	...	...	1	...	..
Niagara	...	...	...	...	...	..	1	1
Nichol	...	...	...	...	...	..	...	..
Nissouri, E.	...	...	...	...	8	..	...	..
Nissouri, W.	...	...	...	.. .	1	1	...	..
Nottawasaga	1	...	10	...	3	1	9	1
Nepean	78	2	69	3	37	3	...	2
Nassagwaya	1	...	...	...	...	..	1	1
Norwich, N	...	...	...	...	...	..	1	..
Normandy	...	...	...	...	...	..	...	..

Cases and Deaths from Contagious Diseases by Municipalities for 1902.—*Continued.*

Townships	Small-pox.		Scarlatina.		Diphtheria.		Typhoid.		Townships.	Small-pox.		Scarlatina.		Diphtheria.		Typhoid.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Nelson									Shefield					2		3	
Oakley									Sherborne &c.					1			
Oliver							1		Sherbrooke, S								
Onondaga									Sherbrooke								
Ops			8	1					Smith								
Oxford							2		St. Vincent					2	2		
Orillia									Sophiasburg								
Oro			8	2	7	1			Southwold							3	
Osprey	76				6	1			Stamford			1					
Otonabee	1		5		9	2			Stanley								
Oxford, E			8	1	1				Stanhope								
Oxford, N									Stafford	4							
Oxford							1	1	Stephen	50							
Olden			10						Stisted			1		1			
Oakland									Sullivan					2		7	2
Osnabruck	9								Sunnidale								
Oneida									Sydenham								
Oso	1								Seymour								
Peel	1			2	2	1		1	Snowden								
Palmerston	1								Strong	1							
Percy	1				5	2	7	1	Sarnia							2	2
Pilkington									Sault Ste Marie	3		18		4		30	
Perry	7				9				Sandwich W								
Plantaganet, N	55		1	1	7	2	2		Somerville								
Plympton									Sidney							10	1
Plummer			4						Tay			1	1			1	1
Puslinch	18		4	4		2		2	Tecumseth	1							
Portland	1								Tehkummah								
Pelham			4						Thessalon	4							
Petewawa									Thorold								
Pittsburgh							1	1	Thorah								
Papineau					1	1			Tilbury, N	3		1		10	3		
Pembroke	1								Tilbury, E	40						15	
Pickering			5	1	9	2	3		Townsend						1		
Proton									Trafalgar	3							
Pelee					6	1	4	1	Tilbury, W					4			
Pakenham	5								Toronto Gore			4					
Raglan									Tuckersmith					1			
Rainham	7		4	1					Turnbury					1		3	
Raleigh	28		18		8	1			Tyendinaga			1	1			1	
Rama							1		Tossorontio								
Ramsay									Tiny	1				1			
Radcliffe									Thurlow								
Rayside									Toronto	18		15		6		5	
Reach			10	1	1				Usborne								
Richmond									Uxbridge					9		15	1
Rochester			2		1	1			Vespra								
Ross	1		4	1					Verulam					2		2	
Rolph, B. & W.	10								Van Horne						1		
Roxborough	31		1						Wilberforce			3					
Ratter&Dunnett									Williamsburg								
Ryde									Wabigoon			6	1			1	
Ryerson									Williams, E								
Rawdon									Wainfleet			50		20		7	
Romney					1	1	1	1	Wallace			1		5		1	
Russell	300	1	6		12		2		Woodhouse	11						2	2
Sarawack							1		Walsingham, S.								
Sandfield									Wawanosh, E	16						3	
Sandwich, S.					4	2			Wawanosh, W			1	1				
Saltfleet					7	1	5	1	Waterloo	1		10				15	
Saugeen					1	1			Wellesley			20		1		17	1
Scarborough			6		14	1	1		Westmeath	5				2	1	2	
Schrieber	1		24	3	1				Westminster					1	1	2	2
Scott									Wollaston								
Scugog					1		1	1	Watt								
Sebastopol									Willoughby								
Seneca	3				1	1			Walsingham, N.					6			

Cases and Deaths from Contagious Diseases by Municipalities for 1902.—*Continued.*

Townships.	Small-pox.		Scarlatina.		Diphtheria.		Typhoid.		Townships.	Small-pox.		Scarlatina.		Diphtheria.		Typhoid.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Wilmot.........	2	...	...	....	4	1	4	..	Whitby	....	....	....	....	...	..	....	..
Wolford........	1	....	....	....	....	..	....	..	York.....	2	....	16	...	30	3	....	..
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